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ADVANCED MATERIALS

Irish Academic Researchers Discover New Magnetic Material

91WS0202B Paris INDUSTRIES ET TECHNIQUES in French 25 Jan 91 p 13

[Unattributed article: "A New Magnetic Material Is Born"]

[Text] Researchers at Trinity College, Dublin, have just discovered a new magnetic material. An alloy of samarium, iron, and nitrogen ($Sm_2Fe_{17}N_3$), it will seriously compete with, if not replace, neodymium-iron-boron, which had until now been the highest performance magnetic material. The samarium-iron-nitrogen alloy remains magnetic up to 475°C, compared to 320°C for neodymium-iron-boron. This gain in what is called the Curie temperature is essential in permanent engine magnets, a common application. The material discovered by the Irish withstands temperatures of 200°C without losing its magnetic properties. In contrast, the highest performance neodymium-iron-borium magnets are limited to 150°C. In addition, for cost and power requirements similar to those of its competitor, samarium-iron-nitrogen, dubbed "Nitromag," is corrosion-proof.

"The year 1991 will be the decisive for the production of Nitromag," according to Michael Cory, who heads the Dublin team. "We are working on this with Siemens and Rhone-Poulenc. The procedure involves a solid-gas reaction between samarium-iron powder and nitrogen. And I can well imagine that this procedure will open the way for other magnetic alloys that have been impossible to produce until now." This technological breakthrough represents a major opportunity, since it could give the European high-performance magnet industry a significant edge. The Japanese, who are masters of the neodymium-iron-borium technology, are responsible for over half of the world production of permanent magnets, estimated at $2.1 billion in 1990.

AEROSPACE

European Space Agency Budget Increased

91WS0147B Paris AFP SCIENCES in French 20 Dec 90 p 7

[Article: "2.1 Billion ECUs for ESA to End of 1995"]

[Text] Paris—By decision of the Board in the course of its 12-13 December meeting, the European Space Agency [ESA] will have a general expenses budget and a scientific budget, totaling together 2.1 billion European currency units [ECU] (14.7 billion French francs), for the period ending some time in 1995.

The Board, presided for the second time by Mr. Francesco Carassa (Italy), addressed the proposals advanced by the Agency's general manager, Mr. Jean-Marie Luton (France), and approved them.

The ESA Board proposed opening a supplementary ECU84 million credit line to enable the continuation of work in progress on the Hermes space shuttle until April. The proposal was to be approved by the Hermes program management on 18-19 December. This sum will cover the period until the launching of the second phase of the plane's design studies, which in turn depends on decisions to be made by the forthcoming European space conference, at the ministerial level, next year.

To prepare the ministers conference, the Board voted to create a working group consisting of two delegates from each of the 13 member countries. The group is to elect its president at its first meeting, the place and date of which have not been decided yet, and present an initial report to the Board at the latter's next meeting in March. This report will address the studies in progress on the contemplated European orbital infrastructure and its operation.

Approval of the scientific budget was considered essential to the full realization of the latter, which runs to the end of 1995. The program management had requested an increase of 5 percent annually to the end of 1994. It obtained a lump sum of ECU1.3004 billion to cover its needs until 1995.

Chromo 20R Videoscope Used for Fissure Detection on Ariane 5

91WS0175B Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 90 p 92

[Text] Each of the two solid-propellent boosters of the Ariane 5 launcher will be made up of three segments: two weighing about 100 metric tonnes, made on site in Kourou by the Regulus company, and one weighing approximately 20 metric tons, manufactured in Italy by the BPD Company and then shipped to Kourou.

The two manufacturing sites must be equipped with identical means for inspecting solid propellent loads: Possible molding flaws in the combustion channel (propellent pick-up, cracks) must be detected and measured with an endoscope. Defect-inspection specifications stipulate that cracks one centimeter long and several millimeters deep and cavities several cubic centimeters in size, be detected and measured, due to material pick-up. "We have chosen the Chroma Company's Chromo 20R videoscope system for visual inspection and 3D measurement of the propulsion units' central duct; a relief view is afforded by two video cameras observing the same scene," the SNPE's (National Explosives Company) Patrick Lamarque told us. A computer matches up the identical points, then calculates the three coordinates of the point observed.

Anomalies Detected Through Image Processing

Since the combustion channel has a large inner surface (30 square meters per segment), a large number of points must be processed, requiring considerable computational speed. The measurement system is bolstered by a

real-time sign-processing board. A triaxial robot perched on a telescopic boom moves the cameras in the vertical load, keeping to a fairly loose grid. If a flaw is detected, a second mode of operation is triggered, with a finer observation pitch. "A detection system will automatically recognize the anomalies through continuous measurement of the channel radius, and small defects (possible cracks) will be automatically detected through a second technique employing image-processing methods.

SPACE 3D Contactless Measuring Device Adopted for Airbus Testing

91WS0175C Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 90 p 93

[Text] Aerospatiale's Saint-Eloy factory houses one of the first 3D non-contact measuring devices—Kern/Leica's SPACE (system for positioning and automated coordinate evaluation)—installed in France. Its job is to evaluate the interchangeability of Airbus engine shafts. Each shaft is a complex, massive mechanical system that provides liaison between the wings made by British Aerospace and the jet engines of different manufacturers that equip the airplanes.

Less Than an Hour To Check Over 50 Points

Until now, interchangeability was qualitatively assessed (good/bad) with mechanical tooling placed on the shafts. From now on it will be quantified, with tolerance intervals of 0.2 mm, by the SPACE system, which also allows the use of statistical computations.

SPACE is a system of automated theodolites, adapted for repetitive, fairly stationary measurements, designed to capture either a limited or large number of points in a minimum of time. The two-theodolite system installed at Aerospatiale is learning programmed. "The measurements had to be very rapid, [taking] less than an hour, to check 50 points per shaft," says Jean-Paul Oury, in charge of quality control, "and they had to be able to be integrated into the manufacturing cycle." In the future, SPACE will also be used for periodic measurements of the shaft-manufacturing tooling.

German, Swedish Firms Develop MAXUS Microgravity Project

91MI0220 Munich NEW-TECH NEWS in English No 4, 1990 pp 31-32

[Text] In industrializing the TEXUS program (technological experiments in microgravity), MBB-ERNO decided to add a new dimension to this system based on sounding rockets. The MAXUS program was developed in cooperation with the Swedish partner SSC on the basis of a joint venture agreement established in the summer of 1989. MAXUS comes from the combination of TEXUS and MASER, the Swedish counterpart to the TEXUS program.

The first launch in this ambitious program is scheduled to take place in the spring of 1991. Using the new type of sounding rocket will extend the 6- to 8-minute duration of microgravity achieved so far to approximately 15 minutes. The extra time will provide research with a broad field of utilization.

The basis for this major step forward is a Castor IV B TVA/TVC rocket (thrust vector actuator/thrust vector control), which will take off from the ESRANGE launch site in Kiruna, Northern Sweden. It will be the largest rocket ever launched from Europe. The launch mass will be over twelve metric tons, ten of which will be fuel.

The total payload amounts to approximately 680 kilograms and the experimental payload to some 420 kilograms. For the most part, already existing hardware and experimental equipment from the TEXUS program will be used for the payload in order to guarantee cost-effective utilization.

The rocket will take the payload to a maximum flight altitude (apogee) of nearly 900 kilometers and is controlled by means of a guidance system and a jet. Precision is important here because, once the flight is completed, the payload must come down no further than 70 kilometers away from the launch site.

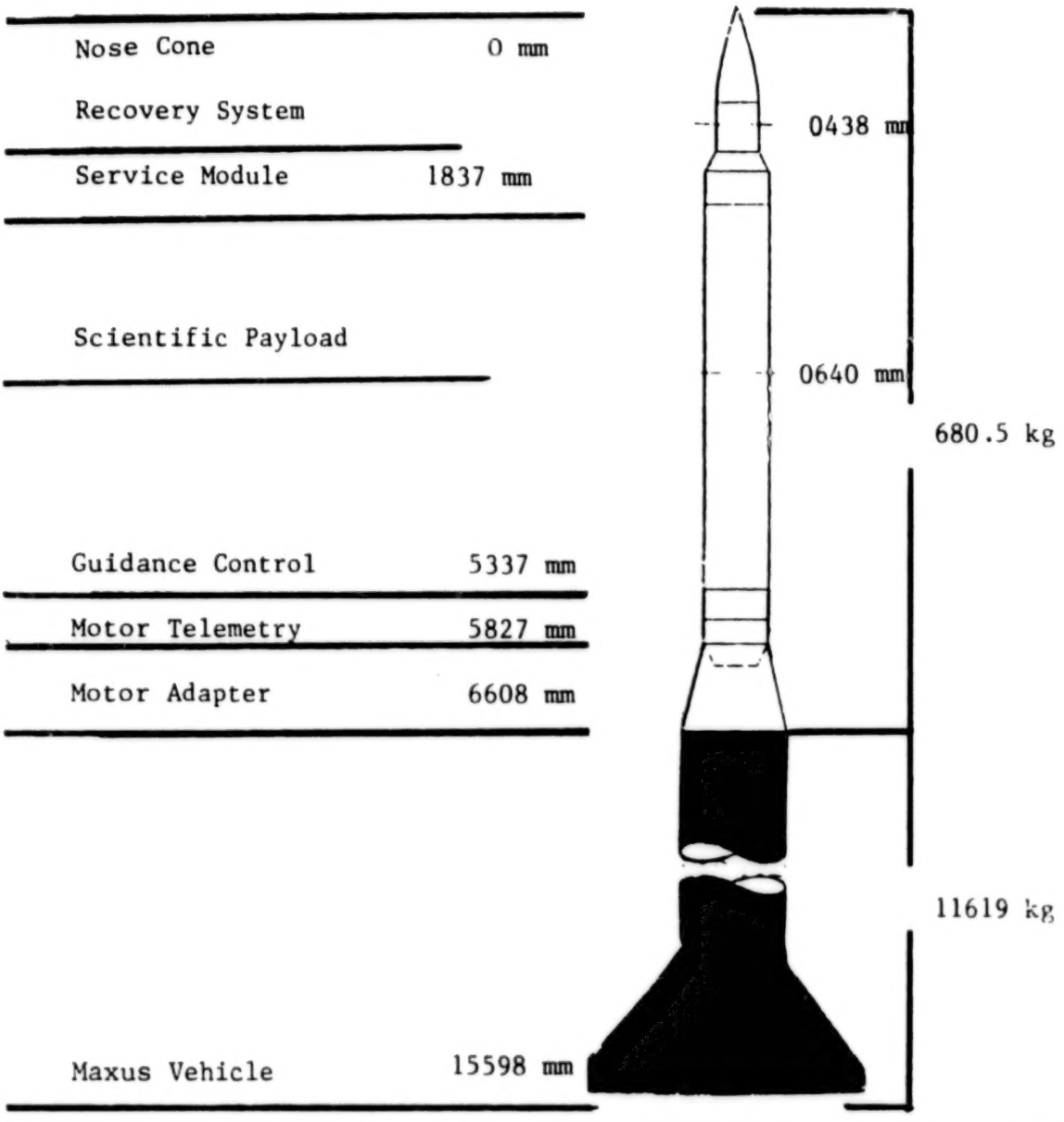
MAXUS not only offers increased microgravity duration—it also includes the advantages already found in the TEXUS program, such as a short processing time of only 12 months from experiment registration to actual experiment flight, accompanied by very low experiment costs.

With this program, space travelers from Bremen and Sweden have taken a major step toward fulfilling the requirements of potential users. Knowing that the launcher's availability is reliable is an important factor for experimenters in the field of microgravity.

Based on the experience acquired during the TEXUS program, experts already know today that local telescience will be utilized with MAXUS as well. This means that there will be five to six on-line connections to the ground station via which the progression of the experiments can be observed and controlled.

MAXUS Mission Sequence

Countdown	- 30 minutes	Housing is removed from the launch pad
	- 90 seconds	Payload switches to battery operation
	- 10 seconds	Control system is activated
	- 3 seconds	Clamps are released
Launch	+/- 0 seconds	Launch
	+ 63.5 seconds	Launcher stage burns out at an altitude of 82 km
Flight	+ 68 seconds	Payload separates from the engine
	+ 85 seconds	Start of microgravity time at an altitude of 160 km
	+ 960 seconds	End of microgravity time at an altitude of 100 km
	+ 980 seconds	Deacceleration parachute opens at an altitude of 6 km



A further objective is to utilize in MAXUS what is called the extended telescience procedure, which has been in use since TEXUS campaigns 21/22. This procedure enables experimenters to directly observe and control the progression of the experiment from their own institutes (for example Cologne, Naples or other stations) via video and data transmission.

Two examples of satisfied customers are Professor Monti from the University of Naples and Dr. Klein from the West German Aerospace Research Establishment in Cologne, both of whom were pleased with this service for scientists. Professor Monti's payload comprised a "floating zone" in which marangoni oscillations were studied. This experiment as well as Dr. Klein's experiment (phase transition of Sf_6 at the critical point with diffuse-light measurement) owe a good part of their success to precisely functioning telemetry.

Video and telecommand transmission is effectuated in the S-band range (approximately 2.2 GHz). Via a mobile satellite radio station from GSOC (German Space Operation Center, Oberpfaffenhofen new Munich), the images are transmitted to the user via geostationary satellites (EUTELSAT4 or OLYMPUS). The user has the possibility to influence the experiment through this same path. It is a state-of-the-art procedure that will help optimize scientific utilization in MAXUS.

MAXUS will make a number of things possible. For example, one experimenter wants to grow a long gallium-arsenide crystal in a solar reflector. The experimenter will be able to observe and control the formation of the crystal from the ground. Although TEXUS previously placed a short six- to eight-minute limit on microgravity time, MAXUS has now surpassed this limit and more than tripled the time (net microgravity time). The objective of the experiment is to grow gallium-arsenide crystals that are as large and displacement-free as possible, which will provide findings concerning other basic technical data, including the growth of these crystals on earth. Gallium- arsenide crystals are of major significance as infrared sensors and rapid switching elements in electronics.

Another experiment on MAXUS could involve a Swiss project in which the formation of aggregates with lymphocytes in microgravity is to be studied. Lymphocytes have the capability of combating viruses in the human body. A deeper knowledge of their behavior can provide valuable information on the treatment of illnesses, and the experiment can also provide further information on the special behavior of lymphocytes. Via video, scientists observe the behavior of the blood corpuscles under a microscope. The extended microgravity time with MAXUS offers decisive advantages here as well.

These are just a few examples of future utilizations. Expanding on the successes of TEXUS, the MAXUS program is a further important element in microgravity research.

Italy, Soviet Union To Sign Space Medicine, Biology Accord

91MI0247 Rome SPAZIO INFORMAZIONI in Italian 6 Mar 91 p 5

[Text] Soviet and Italian scientists have drawn up a memorandum of understanding for bilateral cooperation in the fields of space medicine and biology. This was announced by Professor Giuseppe Tallarida of the ASI'S (Italian Space Agency) scientific committee—on answering a specific question raised by SPAZIO INFORMAZIONI—at a recent meeting in Rome, during a visit to Italy by the vice director of the Institute for Medical-Biological Disorders of the Soviet Ministry of Health, the cosmonaut Professor Valerij Vladimirovich Poliakov. Colonel Andrea Lorenzoni, head of ASI's astronaut department, also attended the meeting.

As Prof. Tallarida pointed out, the Italian-Soviet memorandum provides for joint studies in the following areas: deconditioning and reconditioning of the cardiovascular system, the respiratory and cardiorespiratory system, muscular atrophy, bone decalcification, immuno-hematological disorders, neurological disorders, and human health risk factors (arteriosclerosis, thrombosis, etc.). "Within the framework of Italian-Soviet cooperation, Italy ranks last but not least in this sector," Prof. Tallarida stated and emphasized that there has also been "a widespread high-level interest" among the Italian scientific community. In 1990, in fact, the ASI allocated approximately 2.5 billion lire to studies and research in the area of space medicine and biology.

"We have identified several areas of concrete cooperation," Prof. Poliakov stated. "Italy," the Soviet cosmonaut added, "has highly advanced research technologies, and I think that we can succeeed in solving problems if we tackle them together." In his speech, Col. Lorenzoni expressed the hope that "Italian-Soviet cooperation in the space sector will also be extended to astronaut recruitment and training."

Italian Company's Space Propulsion Activities Described

91MI0193 Rome FINMECCANICA NOTIZIE in Italian 30 Dec 90 p 14

[Text] Ansaldo Ricerche has decided to develop an "arc jet" engine prototype with an applied magnetic field to verify if the external field helps improve the propulsion system's operating conditions. This is based on the concept that the application of a magnetic field helps guide and stabilize plasma in applied space propulsion.

In addition to designing and constructing the "arc jet" engine prototype with a 5-kilowatt applied field, Ansaldo Ricerche has developed the supporting structure for the experiment and the chamber's connecting flange with the required electricity feedthrough to the propellant and magnet, for fluids (gas propellant and magnet cooling water) and signals. The vacuum chamber was then integrated at the Pisa space center after the prototype had been subjected to a series of hydrogen ignition tests.

The main goals achieved were:

- Propulsion system's ignition capability was demonstrated as was the need to achieve the desired field level.
- Stable operations were maintained under repeatable conditions.
- Three operating levels characterized by different types of jets were identified.
- Propulsion system's maneuverability during more frequent observation was demonstrated.

Italian Company To Develop Ejection Seats for Hermes

91MI0236 Rome AIR PRESS in Italian 20 Feb 91 p 449

[Text] In late February, ESA (European Space Agency) will decide on the tenders invited for the construction of the ejection seats for the three astronauts who will travel aboard the European space shuttle Hermes. Whatever

the final decision, the company chosen to construct the seats will be Italian since Fiat Spazio and Aermacchi are the only two bidders. Fiat Spazio is associated with Zvedza, the company that constructs ejection seats for all the Soviet jet fighters and for the Buran space shuttle, while Aermacchi is associated with the British manufacturer, Martin Baker, through the Sicamb company in Latina.

The decision to entrust the construction of the ejection seats to an Italian company falls under ESA's "fair returns" policy based on a single country's investments in its programs. Italy funds 17 percent of the Hermes program, but to date has not obtained an industrial spinoff comparable to that of the other participants. Of the about 20 seats to be supplied, eight will be operational: three for each of the two spacecraft and two spares. The remainder will be used during qualification and launch tests to be carried out either in Italy or in France. They are special "zero-zero" (altitude and speed) seats, that can also be used even when the spacecraft is on the runway, at up to three times the speed of sound, and at an altitude of 15,000 meters. Zvezda has the technology to develop seats with these specifications since they are already used for the Buran shuttle and derive from those fitted on the MIG 290. Aermacchi-Martin Baker, instead, must modify some of their seats, none of which has Mach 3 certification.

The ejection seats, together with their extraction rockets (made by Snia-BPD of the Fiat Group), and the airtight in-flight space suits are part of Hermes' emergency system. Dassault (Hermes' prime contractor) will probably place in-flight suit orders with Zvedza, which already makes suits for the Soviet cosmonauts and future Buran crews. Dornier, the prime contractor for extravehicular suits has assigned the development of the suits to Dassault and Aerazur.

Spain: Mini-Launcher Project Receives Government Funding

91MI0176 Rome AIR PRESS in Italian
16 Jan 91 p 161

[Text] Spain also plans to have its own independent launching capability and has started a study on a national mini-launcher that can send micro-satellites (weighing less than 50 kg) and mini-satellites (weighing no more than 250 kg) into orbit. The Spanish government has allotted approximately 380 billion lire in funding to INTA (National Aerospace Science Institute) which, in recent years, has designed two solid-fuel ballistic missiles (the "100" and "300") models that will serve as the basis for the development of the future mini-launcher. The institute plans to use the launcher primarily for small scientific satellites and microgravity experiments. However, the development of small military observation satellites is not to be excluded. The Spanish are making a secret of their ambition to speculate on the market with the prospect of occupying a small share of the European micro- and mini-satellite market which is estimated to reach $250 million per year toward the end of the decade.

In the meantime, the Madrid Polytechnic is planning to launch a small satellite on a foreign rocket next spring. The satellite, which is designed to study the behavior of fluids in zero gravity conditions, is currently under construction at the school of aeronautical engineering.

AUTOMOTIVE INDUSTRY

EC Approves Auto Emission Controls

91WS0151A Paris AFP SCIENCES in French
27 Dec 90 p 36

[Article: "The Twelve Agree on Auto Emission Standards for Medium-and Large-Cylinder-Capacity Vehicles"]

[Text] Brussels—Meeting in Brussels on 21 December, the Twelve of the European Economic Community (EEC)] agreed on a set of severe auto emission standards, to be applied, beginning in 1992, to automobiles of medium and large cylinder capacities, according to the Italian minister of the environment, Mr. Giorgio Ruffolo. At the current stage of the technology, these standards will compel the manufacturers to install 3-way catalytic converters on new cars having a cylinder capacity of over 1.4 liters.

The EEC ministers of the environment voted unanimously in favor of this measure, which is of considerable importance to the manufacturers of cars and for the protection of the environment.

These new antipollution standards will be obligatory with effect from 1 July 1992 for new-model cars, and from 31 December for all other new cars. Countries wishing to do so, furthermore, are authorized to encourage the purchase of cars meeting these standards as of now, through tax incentives.

Prior to the end of 1992, the Commission will present new proposals to the ministers for further tightening these standards, in the light of technical progress. The ministers are to decide on these proposals prior to the end of 1993.

These newer standards shall not be applicable before 1 January 1996, but may be used as a basis for further tax incentives that member countries may wish to institute. These incentives, however, are not to be made effective prior to adoption of the new antipollution measures. The Twelve had already agreed, in June 1989, on a tightening of the antipollution standards for vehicles having a cylinder capacity of less than 1.4 liters, with effect from 1992.

Experimental 'Clean' Diesel Engines Reviewed

91WS0193A Paris L'USINE NOUVELLE in French 17 Jan 91 p 64

[Article by Pierre Laperrousaz: "Towards the Clean Diesel Engine"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Five buses on the Paris No. 21 bus route have been fitted with self-regenerating filters, which are trapping 80 percent of the characteristic diesel smoke.

The diesel engine, clean? A car driver stuck behind a diesel on a hill would have a hard time believing it—unless the diesel in question was a bus on the Paris No. 21 bus route, between Gentilly Gate and the Saint-Lazare Train Station. For several months, five vehicles on this Parisian bus route have been fitted with particle filters that trap 80 percent of the nauseating, black smoke so characteristic of diesel engines. By the end of the year, the entire line should be "green."

The filters are supplied by Webasto, a German firm specializing in automobile equipment such as moveable sun roofs and independent heating for passenger cars and trucks. With its experience in compact burners for heating systems, it decided to go into filters. The Webasto device uses a burner of this type to regenerate the filter periodically—every 50 kilometers in the case of the Parisian buses, which are no longer in their first youth. The burner, which is triggered automatically by means of a measurement device and a control box, then heats the exhaust gas to up to 700°C, causing the soot in the filter to combust spontaneously. The operation lasts 7 to 8 minutes and uses a third of a liter of gas. In order to withstand the high temperatures involved, the filter is ceramic.

If the experiment is conclusive, RATP [Independent Parisian Transportation Board] plans to equip all of its new vehicles. The main unknown is how long the filter will last. The track record is still too short. In PSA [Peugeot SA] testing on taxis, some filters melted or broke under "particle impact." However, the filters in question were spontaneous regeneration filters in which too much soot had accumulated before spontaneous combustion occurred.

Around 80,000 Francs To Install

However, the filters for large diesel engines currently on the market (Webasto, Volvo, Zeuna-Starker) all use controlled regeneration, which makes it easier to regulate the process. With the Webasto, regeneration is triggered automatically during vehicle operation, almost without the driver's being aware of it. With the Volvo filter, it is done in the garage and is triggered by electrical resistance. In order to prevent an excessively high rate of combustion, which could damage the ceramic mount, an air pump delivers a controlled flow of oxygen throughout the entire cycle. The operation lasts three hours. This is why the Swedish manufacturer, which has sold around 350 of its "city filters," equips mostly delivery or public transport vehicles, which are idle much of the time.

Another trick for prolonging the life of the ceramic mount is to lower the particle combustion temperature by incorporating fuel additives. The city of Athens, which has been running particle-filter-equipped buses since 1987, has recently begun using a diesel fuel with a cerium-based additive. The additive, which is made by Rhone-Poulenc and is being tested for the first time in Athens, lowers the combustion temperature to from 480 to 500°C, for a 1-to-2-percent increase in the price of the fuel. PSA has tested iron-and manganese-based additives. Its conclusion is that, although regeneration is more reliable, the service life is still a problem, owing to iron accumulations in the filter.

Thus, the diesel engine, which emits 10 times less carbon monoxide and 5 times fewer hydrocarbons than the gasoline engine (but as much nitrogen oxide) may soon stop smoking—at least insofar as heavy vehicles are concerned, especially intermittent-usage vehicles like city buses and garbage trucks. However, progress has its price. Because the filter is not yet in mass production, it currently costs between 80,000 French francs [Fr] and Fr100,000 to equip a vehicle, not counting the operating costs directly connected with the service life of the filters.

Another solution will have to be found for cars. The filter—especially when equipped with a burner—is too cumbersome and too expensive. PSA is placing its bets on the catalytic converter. It is more "open" than a filter and burns the soot as it is trapped. However, to work properly, it requires sulfur-free fuel, which is not available everywhere. This puts the ball in the refiners' court.

France: Renault Using New Materials for Recyclable Auto

91MI0175 Milan ITALIA OGGI in Italian 10 Jan 91 p 37

[Article by Andrea Simplici: "A Car to Recycle"]

[Text]The French have found the right name: MOSAIC. However, it is just an acronym that hides an endless phrase: "Optimal Materials for a Car Structure to Innovate Design." Renault has revealed that it is designing its own modular car, a mosaic of new materials, light alloys, plastic, and steel. In a brief two-page release, Renault has presented the recyclable car, a study on the possibilities of reusing single car parts when cars are demolished.

MOSAIC is looking for new materials for car construction. "We want to choose the most appropriate materials for every single operation in a car," Renault explained, "and establish a close link with automotive manufacturers and materials producers." This project overlaps in part with RECAP, a project in which chemical and automotive industries examine the different ways of reusing individual car parts.

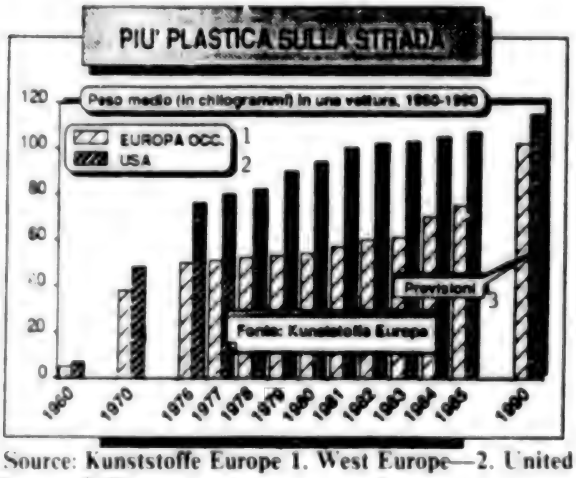
In addition to Renault, seven leading industries will be seated around MOSAIC's tables. Ciba-Geigy will work on structural adhesive products (resins which can resist mechanical stress), DSM will work on light, highly resistant composite materials. Hydro-aluminion will study light alloys, and Sollac, steel. Montedison and Enimont will examine the latest developments in plastics for the final central and rear sections of the future Renault.

The MOSAIC car will appear on the test tracks in early 1993 and production is scheduled to start in 1995. The first investments will amount to 350 million francs over a three-year period.

Plastic is transforming the skeletons of the cars of the next decade. Thirty years ago, a glorious Fiat 1100 came off the assembly lines in Turin with less than two kg of plastic inside it. The car itself was a big metal box. Today, the plastic in a Lancia Prisma weighs one tonne. On average, a European-built car has 22.5 kg of polypropylene. Panels, dashboards, windows, seats, applications in the engine compartment: plastic is reshaping the car of the future. Montedison calculates that over the next five years, each European vehicle will contain at least 40 kg of plastic. The 60 pieces of polypropylene in the cars of today will rise to 110 within three years, and will become 200 in the year 2000: For example the first Fiat car to be manufactured with a plastic bumper was the Fiat 128, 15 years ago. Today, 85 percent of the models have plastic bumpers, a percentage that will rise to 95 percent over the next three years.

Lighter cars (thirty years ago a car weighed 1,200 kg, today it is down to 975) with an increased aerodynamic coefficient (this was halved between 1960 and 1990, dropping from 0.5 to 0.28) that will provide some environmental relief. Technicians at the Ferruzzi company say: "This will definitely be a car that will use less fuel, pollute less, and that will allow for significant energy savings."

More Plastic on the Road. Average wieght (in kg) in a car, 1960-1990.



Source: Kunststoffe Europe 1. West Europe—2. United States—3. Forecast

Renault Uses Visionless Gripping Robot

91WS0189C Paris L'USINE NOUVELLE/ TECHNOLOGIES in French 17 Jan 91 p 14

[Article by Thierry Lucas: "Loose Parts: Visionless Gripping: "Thanks To a Smart Gripping Head, Robokits Unpack Brake Disks in Renault's Mans Factory"]

[Text] There is at least one principle Jean Mouton, the general director of ABC Productique, uses when designing his handling robots, and that is to steer clear of vision systems. It is not that he is allergic to them, but that he wants to build simple, robust—in a word, productive—machines.

The two Robokits (made of modular components) installed in the Renault Mans factory put this philosophy to work. Their job is to unpack loose brake disks in bins, for automatic feeding of a machining line. To do it they use a triaxial crane, at the tip of whose vertical shaft is a gripping head with an electromagnetic "suction cup." The suction cup, which has been patented by ABC, can be moved to adapt to the random positions of the disks in the bin. It detects the presence or absence of parts and the grasping of two or more parts (when that happens the robots lets go and starts over). In this way, the disks are set down one by one in a cleared space and sent to a roller table. Parts placed backwards run up against a rachet that triggers a tilter which pivots them 180 degrees. "In most cases," insists Jean Mouton, "you should be able to orient a loose part without a vision system. The idea is to design a "smart" gripping head using sensors tailored for each type of part."

Renault expects to recoup its investment in the two unpacking stations installed last summer in less than two years.

Italy's Laben Involved in EC Automotive Project

91MI0211 Milan ITALIA OGGI in Italian 5 Feb 91 p 18

[Article by Silvia Pagani: "A 'Black Box' for Cars Too"]

[Text] The protagonist in news items on air disasters is now finding a place in the automotive world too. It is the "black box," the technological instrument installed on airplanes to record the "history" of each flight that an EEC program plans to transfer to road vehicles as well. The Italian company Laben, which specializes in space technology, has been assigned this task.

Laben is currently developing the DRACO (Driver and Accident Coordinated Observer) project under the DRIVE (Dedicated Road Infrastructure for Vehicle Safety in Europe) program, which is currently the center

of international attention at a three-day conference ending tomorrow at the Palais des Congres in Brussels, to create an electronic "observer" for use in cars or other vehicles.

Its task is to "capture" information on the car's situation and memorize it. A series of sensors located throughout the car, keep it constantly informed on the recorded speed, the dynamic behavior of the structure, acceleration and deceleration, on possible tire skidding, and finally "weather-related" road conditions. In short, nothing will escape the watchful eye of the black box that will permit the precise cause of an accident to be ascertained.

The electronic unit that stores the data is the brain of the "road observer," and was developed by the Italian company (which has already built a prototype). It can memorize events in chronological order, focusing on more recent events, and "suppressing" past events little by little.

However, this is not all there is to DRACO (which has cost about 500 million lire in research over three years). There is an even more ambitious project for the future: installing a man-machine interface in the black box to evaluate the response and reaction times of the driver. This sophisticated system, (which would record for example, the pressure of the hands on the steering wheel or eye movements), would keep the driver's attention and physical condition constantly under control. For the time being, however, this is just a hypothesis.

Many other projects revolve around DRIVE. The EEC's ECU120 million program is "stimulating" companies and European research institutes to develop leading edge technology to make the roads safer and transport more efficient.

The ideas are not lacking here: from the application of the American Global positioning system (used in both the military and civil sectors) in the automotive sector to recognize the position of a car via satellite, to "intelligent roads": magnetic tracks that run under the asphalt, from the application of artificial intelligence to traffic control and reducing pollution.

The DRIVE program was launched in 1988 and begins its pilot project development phase at the Brussels conference. Among the more interesting goals of the program is the creation of an environment that integrates roads and transportation, thereby creating a communication network between vehicles and road infrastructures.

Could this be an opportunity to make lines and traffic jams a thing of the past? According to experts at the Brussels conference, telematics applied to road transport will become a market with a 15 trillion lire annual turnover by the end of the decade.

DRIVE is promoting a total of 72 transnational projects with a funding of 180 billion lire, half of which is being borne by the EC budget.

BIOTECHNOLOGY

EUREKA Agar Extraction Project Outlined

91AN0256 Paris FRENCH TECHNOLOGY SURVEY in English Dec 90-Jan 91 p 3

[Article: "Polysaccharides With High Added Value"]

[Text] Agar, the gelling agent extracted from certain red marine algae, is used in the food industry in milk preparations and in confectionery. Demand for this polysaccharide is increasing at 25 percent a year and it is increasingly important in biotechnology.

Problems are being caused by the variable quality of supplies, due to seasonal variations and changes in the processing of the algae. For this reason, the EUREKA [European Research Coordination Agency] project EU-440, proposed jointly by the Pronatec company, the French Glucide Development Centre, and the British PBL company, aim to produce agar and agarose on demand, under controlled conditions in a bioreactor, using molecular biology (modified bacteria).

The Pronatec company will handle the physiological and genetic engineering aspects, working together with a laboratory of the University of Lille and the microbiology laboratory of the Amiens University Institute of Technology. It will supply the agar extraction units in collaboration with the Applexion company. The task of the Glucide Development Centre is to carry out market surveys and prepare a business plan.

PBL will adapt its bioreactors for the culture of microthalli and/or isolated agarophyte cells. The preliminary and industrial pilot stages will be carried out in Ireland and Spain.

This four-year European programme has a budget of ECU 4 million.

French Firm Develops Advanced Supramolecular Biovector

91WS0202C Paris INDUSTRIES ET TECHNIQUES in French 25 Jan 91 p 15

[Article by Yves Ciantar: "Homing Head for Medicines"; first paragraph is INDUSTRIES ET TECHNIQUES lead]

[Text] A&S uses supramolecular biovectors to guide medicines to the diseased organ.

A&S-Biovecteurs is preparing a revolution in drugs. The young Toulouse company is developing supramolecular biovectors. The design of these molecules dissociates the transport function from the curative function. In the words of Daniel Samain, the CNRS [National Scientific

Research Center] researcher who founded A&S, this type of approach should "concern 15 percent of the world medicine market before the year 2000." The prediction is optimistic, but not wild. According to Daniel Samain, the first applications will involve oncology.

Medicine-Vector: A Patentable Combination

"The supramolecular biovector (SMBV) is composed of a vehicle and a passenger. The vehicle consists of an outer polysaccharide envelope, which deceives the organism by merging with a component that is, say, responsible for the transport of cholesterol in the human body. The passenger—the medicine—is hidden in the deceiving vehicle and released on reaching its target," Daniel Samain explained. "The trick in reaching the organ is to use the body's veritable 'subway,' the biological transport system."

In 1987, the team led by Daniel Samain, the head of the chromatography department at CNRS's Microbian Biochemistry Laboratory, became interested in vectorization. In 1989, the team members left CNRS and founded A&S-Biovecteurs with the help of IRDI. Their goal was to create the medicines of tomorrow by offering their industrial expertise in biovectors to pharmaceutical laboratories. "Our objective is to become a codeveloper," according to Daniel Samain, who was the last one to cross the Rubicon, in early 1990.

Prospects are vast. At a time when pharmaceutical laboratories are discovering few new molecules, biovectors offer new possibilities. As Daniel Samain explained, "Adapting existing medicines to biovectors lends them new life, with an advantage: the medicine-vector combination is patentable." This prospect will appeal to the laboratories, whose products are passing into the public domain. The other field of application involves "the new 'human' molecules" produced by genetic engineering. These will have to be gotten to their active site. For example, coupling insulin with a biodegradable biovector would allow it to get past the barrier of the stomach. It could be administered orally. Shots would no longer be necessary."

Other companies are working along the same lines. In the U.S., Liposome Company and Liposome Technology "are using another vector, the liposome." Daniel Samain does not believe in it. "The major problem with liposomes is industrial production." Another competitor, the English firm Cortecs, offers a microemulsion-based technology.

Daniel Samain is unperturbed by the prospect of fierce competition. "The first application should be out by the end of the year, in cosmetology. After that comes oncology. I have other plans, such as a synthetic vaccine."

Germany: Max Planck Microbiology Institute Opens

91MI0203 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 30 Jan 91 p 7

[Text] The Max Planck Institute of Terrestrial Microbiology has started work in Marburg. It specializes in research into the ecology of microorganisms—bacteria, fungi, and protozoa—in soils, areas susceptible to flooding, and damp grounds. The scientists appointed by the Max Planck Society board to direct the institute, Professor Rudolf Hauer from Marburg University and Professor Ralf Conrad from Constance University, took up their posts at the beginning of the year.

The various ecosystems are currently being studied in Bayreuth, Goettingen, and Marburg. The areas covered by the new Max Planck Institute of Terrestrial Microbiology include biogeochemistry. This department is studying the extent to which the metabolism of microorganisms in the soil—the formation and conversion of methane, carbon monoxide, nitric oxides, and hydrogen—depends on individual local factors. In parallel with this study, ecophysiological aspects are also addressed using laboratory tests to explain the behavior of individual microorganisms in their natural habitats. Biochemistry is another important subject; it will throw light on the molecular mechanisms of microbial metabolism, the enzymes and coenzymes involved, and the reactions that they trigger. Last but not least, the "organismic interactions" section studies the interactions of microorganisms both with one another and with higher organisms in the soil and examines the modifications that microorganisms are undergoing as a result of environmental factors.

The new director, biology professor Ralf Conrad from Konstanz, heads the biogeochemistry department. His research to date has focused primarily on the formation and consumption of atmospheric trace gases as a result of bacterial activity in different ecosystems and on the sources of and sinks for anthropogenic, or man-induced, nitric oxides.

His colleague, Professor Rudolf Thauer, who is head of the biochemistry department, has been professor of microbiology in the Phillips University biology department in Marburg since 1976. Thauer is one of the scientists who have applied thermodynamic principles to microbial biochemistry, thus adopting a new approach to the study of energy metabolism in microorganisms. The new Max Planck institute has been set up in Marburg because the local university has strong biochemistry, genetics, microbiology, and ecology departments and also hosts the German Research Association's special research program on ecophysiology. The institute will work on university premises and in a provisional building until its own building is ready.

Italy: Status of Human Genome Project Evaluated

91MI0191 Brescia BIOTEC in Italian Nov-Dec 90 p 54

[Text] Italy's human genome project was launched in 1987 with a 5.3-billion lire budget for the first three years and an initial 15 operating units. It has now become a subproject of the Genetic Engineering project directed by Professor Tocchini Valenti and is coordinated by Professor Renato Dulbecco. This step has guaranteed the operating units, which have now become 29, more funding for the coming years (12.5 billion lire over five years excluding labor costs). The Italian group is working on a segment of the X chromosome containing a large number of sites (the so-called 'fragile sites') that, if expressed, are the origin of various diseases. The results obtained by the principal research groups were illustrated at a conference held on 25 and 26 September at the CNR [National Research Council] in Milan. The project involves two types of carriers primarily: cosmids (of bacteria) and yeast carriers (YACs [Yeast Artificial Chromosomes]). The Milan group is working primarily on the first, while the Naples and Rome groups work on the second. At Naples, work is performed on a gene bank of YACs of the Xq24-qter region. Many clones have already been studied in detail, one of which contains the G6PD gene, whose sequence is sufficiently conserved to be able to code for the active enzyme if introduced into animal cells. At Rome, the method used to order YACs is different: studies are carried out on the overlapping of two YACs based on their recombination capapability during yeast meoisis. At the same time Milan is preparing a well organized map of cosmids in the Xq24-qter region based on reciprocal hybridization. A direct approach for the identification of genes in the same region is being carried out at Pavia, while the proteins expressed from the genes are examined in the laboratories of Padua and Brescia. Many of the laboratories involved in the project are in the meantime developing new techniques to make DNA sequencing more rapid.

The Trieste-based group has presented several protocols of DNA extraction from various matrices including: bacteriophages, phagomides, and DNA plasmid. These protocols can be adapted to equipment for automatic DNA extraction designed by Talent (a biotechnology R&D company) that will be introduced on the market by Kontron Instruments, at RICH-MAC 90 [Chemistry and Laboratory Equipment Exhibition], Milan.

The automatic extractor will consist of a roboticized arm with eight channels to manage eight samples simultaneously every 20 minutes and furnish the extracted DNA suspended in water. The Frascati-based laboratories, are using a tunnel-effect scanning microscope in an attempt to explore the possibility—through the observation of DNA circular plasmids and their helix conformation observed with the precision of a few angstrom units—of obtaining images of oligonucleotides that allow for direct DNA sequencing.

Added to these efforts is the work being done by the bioinformatics and data base groups to code and interpret the sequences as they become known.

COMPUTERS

European Neural Computer R&D Reviewed

91WS0183A Paris ELECTRONIQUE HEBDO in French 24 Jan 91 pp 14-15

[Article by Claire Remy: "Everything Set for Neural Signal Processors"; first paragraph is ELECTRONIQUE HEBDO introduction]

[Text] LEP (Philips Electronics Laboratories) and Telmat have built a neural computer based on specialized chips. It is an initial European step toward industrialization.

LEP researchers have unveiled their VLSI (very large-scale integrated) neural circuit, L-Neuro, paving the way for neural signal processors in so doing. The principal advantage of this specific circuit over a neuromimetic software program is reduced learning and problem-solving time, which can be cut by a factor of 100 or more.

LEP has been working for several years in the field of neural networks, especially on their hardware integration, [in areas] ranging from the design of dedicated VLSI circuits to the development of specialized machines based on those chips. The circuit in question, called L-Neuro, for Learning Neuro Chip, represents the hardware application of the neuromimetic models experimented with on software programs. Each L-Neuro simulates the functioning of 64 neurons. Made using CMOS [complementary metal oxide semiconductor] 1.5-µm technology by VLSI Technologies in the United States, the chip contains RAM [static random-access memory] for storing 1,024 neural connections (for 16 input and 64 output neurons), and 16 processors working in parallel to compute the status of the 64 neurons and their connections. The neurons can be organized into two layers of 32 neurons, or into a layer of 256 neurons (input layer) and one containing 4 neurons (output layer). Each neuron has 1 to 8 bits and their synaptic coefficients are coded on 8 or 16 bits.

A Microprogrammable Learning Mechanism

L-Neuro's novel feature is its integration of a microprogammable learning mechanism. This was made possible by a considerable reduction in the time necessary to adjust the neural connections during the learning phase. The circuit's capacities were exhibited in an image-compression demonstration during a conference in London in February 1990. The technique consisted of using a neural algorithm to determine the relevent data in a picture, in order to compress it without losing information. To use this algorithm, the relevent data must be learned, which L-Neuro can do for the images in real time. In order to develop neural computers using

LEP Neural Processor

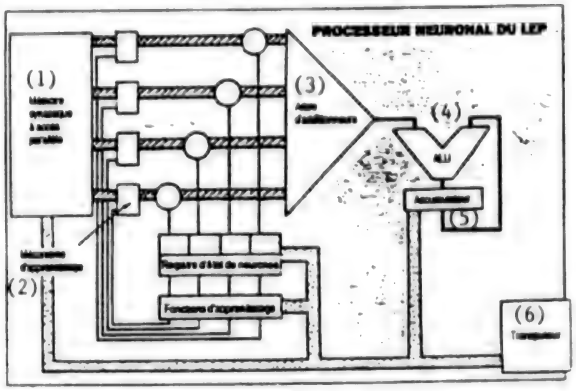


Figure 1. LEP's VLSI neural circuit L-Neuro. The T800 transputer, shared by four L-Neuro's, controls learning and gives the network its flexibility. This circuit is used as a basic building block.

Key: 1. Synaptic memory with parallel access—2. Learning mechanism—3. Adder tree—4. ALU—5. Accumulator—6. Transputer

circuits of this kind, it is essential to adopt a flexible architecture so as to be able to install a wide variety of algorithms and neural network structures. Indeed, it is commonly neccessary to use different approaches for a given application, such as image processing. The construction of algorithms is thus the neural equivalent of binary decision trees. To insure this flexibility, L-Neuro was designed to be combined with a computer: not just any computer, since the machine in question is an (Inmos) transputer-based system, Telmat's T-Node. These processors adapted for parallel processing combine well with such circuits: Indeed, they are rapid enough to execute part of the communications protocol needed when several neural chips are used. Each of the T800 transputers is connected to four L-Neuro circuits which it commands, thus making a 256-neuron (4 by 64) network, explains Christian Pflieger of Telmat.

The transputer monitors all the loading data. Several transputers can be hooked up to communicate with one other, for larger networks.

Telmat has announced that the machine is being readied for manufacture starting in 1991. Many industrial applications are planned: TV picture compression, signal recognition, etc. The gain over software simulations on a transputer network is especially notable in the learning phase: It ranges from a factor of 20 to 100. This gain allows learning time to be cut to several days instead of a year, which is the average length of time required for fairly simple applications with software-based methods. Furthermore, Telmat is continuing work on a new generation of neural computers that will include more neurons and will work faster. Another L-Neuro application consists of incorporating the chips into PCs to build "numerneural" signal processors [for] the general public.

Processing 150 Billion Synaptic Connections Per Second

In the United States, DARPA (Defense Advanced Research Project Agency) announced last year a 27.8 million-dollar two-year program to develop a neural processor in collaboration with Intel. The processor, christened Touchstone, will be used as the core of a parallel computer with 2,000 processors. One of the first spin-offs of this project is a 1,000-neuron analog circuit, the N1000, developed by Nestor Inc. The N1000, which is capable of processing 150 billion synaptic interconnections a second, is a learning unit and includes the RCE self-organized neural model patented by Nestor. The N1000 chip will be built with Intel's participation, using the latter's flash memory technology. Besides neural cells, it will use about 250,000 nonvolatile memory cells to store synaptic weights, and an output classifications monitoring mechanism. The N1000's goal is to achieve a decision-making time of about one micro-second (instead of the millisecond of software simulation.)

Other American and Japanese companies are in the process of developing integrated neural circuits. At Neural Semiconductor, a digital circuit (DNNA, expansion unknown) processes 10 million connections, or 100,000 forms, a second. Micro Devices's "Neural Bit Slice" (NBS), designed to be assembled onto a board in a PC, is being evaluated. A single NBS contains 8 digital neurons, allowing it to process an application 20 times faster than the usual programs running on 286.

In Europe, the Esprit [European Strategic Program for Research and Development in Information Technologies] II Pygmalion project, whose purpose is to promote neural network applications in European industry, also plans, in addition to developing software, to integrate neural networks into silicon using WSI whole wafer technology. This will make it possible to integrate a large number of neurons on a single chip. Demonstrations of VLSI networks of several neurons have already revealed excellent performances. In France, various research projects are underway in the universities (Orsay, Grenoble, etc.). The INPG [National Polytechnic Institute at Grenoble] is developing a neural processor on silicon using 1.5-µm CMOS technology.

Work on neural components often involves other new technologies. The American start-up company Nova Technology, for instance, has announced it will market a neural circuit integrated into a superconducting material (see ELECTRONIQUE HEBDO No. 167 of 4 October, 1990.) The chemistry department at MIT (Massaschusetts Institute of Technology) is using chemical transistor technology to make neural components (see ELECTRONIQUE HEBDO No. 169 of 18 October, 1990.)

Boxed Material: From Software Simulation to Siticon Integration

There has been talk of neural networks for several years now. But these entirely different information-processing systems have heretofore primarily been simulated using

software programs. To get to the stage of incorporating them into silicon, researchers have had to go through three steps.

Until the beginning of the eighties, they did theoretical work to try to find new methodologies and establish the principles of neural computing. The second step consisted of optimizing the host computer on which the simulation programs run, to speed up processing of neural network simulation. It was not until the third step that "real" neural computers appeared. The latter are based on the hardware integration of neural networks in the form of electronic and optical circuits, overwhelmingly parallel in their functioning. Two broad approaches are colliding head on: analog and digital circuits. Partisans of the first approach stress the fact that input signals are generally analog. However, analog circuits traditionally suffer from the effects of technological variability and are more sensitive to noise; in addition, given the current state of the technology, most integrated analog circuits are unable to include the learning phase, which must still be calculated on a conventional computer. On the other hand, it is much easier to integrate synaptic coefficient modifications in digital technology. What is more, there is much greater control of the techniques for manufacturing digital circuits. Besides digital, analog, or hybrid solutions, an outside microprocessor can be used to compute the synaptic coefficients of each neuron. This solution, which is very flexible since different learning algorithms can be installed, was adopted for the LEP chip, in collaboration with the computer manufacturer Telmat.

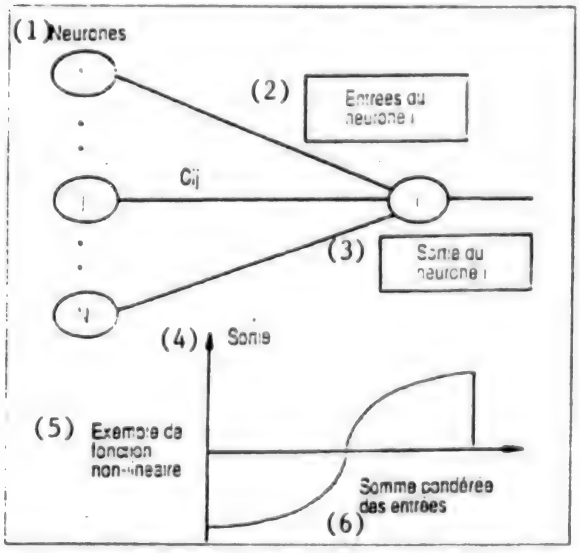


Figure 2. A neural circuit component, or "neuron", is a basic processor that performs two functions: storage of the network's synaptic coefficients, Cij, acquired during the learning stage; and computation of output, which is a function of the weighted sum of the input data.

Key: 1. Neurons—2. Input data of neuron i—3. Output of neuron i—4. Output—5. Example of nonlinear function—6. Weighted sum of the input data

New European Microprocessor Initiative, OMI, Presented

91WS0184A Paris ELECTRONIQUE HEBDO in French 24 Jan 91 p 16

[Article by Francoise Grosvalet: "The Euromicroprocessor Enters the Lists"; first paragraph is ELECTRONIQUE HEBDO introduction]

[Text] The Brussels Commission is polishing the architecture for a high-performance microprocessor: One of its strengths will be its software compatibility with existing designs.

The European initiative dubbed OMI, for Open Microsystems Initiative, aims more to develop a family of components, systems, and development and applications software than a microprocessor. Its ultimate purpose is to provide a complete hardware and software system within five years: The system will be based on the technologies that will be available for use in production at that time, and that perhaps will have been developed by other European projects, such as JESSI.

The European microprocessor—or rather the family of European microprocessors, if there is a European microprocessor, which is not yet entirely certain (see boxed material)—should be a 64-bit microsystem (but compatible with 32 bits). It will integrate about 100 million transistors on a "chip" of approximately 5 square cm using 0.3 µm technology. Objectives such as these, targeted for around 1995, should place it squarely in line with the competition: the top microprocessor manufacturer, Intel itself, does not anticipate such an eventuality before the end of the nineties.

With the Post-RISC Generation In Mind

OMI aims to provide the necessary infrastructure for the support and development of new microprocessors, their software environments, and the applications that use them. The project includes the design of circuits and macrocells (to customize their installation and, most important, provide better compatibility with what is already there). But the bulk of the activity should focus on developing demonstration systems with the appropriate development tools and systems software. Initial applications targeted mainly involve the dedicated control sector, one which could, according to the Dataquest Research Company, represent over 50 percent of microprocessor applications by 1995.

OMI is not seeking to compete with even the best-performing current RISC architectures. The goal is to develop the post-RISC generation, while allowing users and licensed manufacturers of current technologies (Mips, Sparc, 88000) to slowly gravitate toward the new. OMI is a continuation of ESPRIT. It is therefore natural

that the first architecture studies were already launched during the second phase of the precompetitive European research program in information technologies. One example is the OMI-MAP project (Microprocessor Architecture Project), kicked off for a three-year period in December of 1990. It aims to develop a microprocessor architecture utilizing new techniques such as dynamic instruction prediction and ultra-high-speed context change, to provide general-purpose parallel computers with virtual processing, virtual memory, and virtual communication capacities in a multi-processor environment that includes up to several thousand basic processors.

The components, systems, macrocells, and software programs consistent with this architecture will be developed in coordination with other ESPRIT projects such as GP-MIMD, whose purpose is to develop components for high-performance parallel computers. SGS-Thomson/INMOS's H1 microprocessor, to be introduced next April, could serve as a starting point for these developments. But the studies are also based on Acorn's ARM and on the experience gained by other manufacturers with Mips's R3000 and the Sparc.

Software Compatibility First

Particular attention will be paid in the OMI program to minimizing the costs of the software gravitation of classic microprocessor architectures. This will be made possible by providing an emulation of what the European microsystem will be as early as possible. It will also rely on the design of a virtual binary interface, and the creation and adoption of adequate international standards. To facilitate the gravitation, the OMI microsystem is expected to support the Unix operating system that is increasingly emerging as the standard.

The MAP project, coordinated by SGS-Thomson/Inmos, is a central step in the OMI; but it will remain a preliminary step until the Twelve's cabinet adopts the specific OMI program. The program is divided into three distinct parts. Bull, at the head of a group of user companies (Olivetti, Acorn, ABC, Siemens, and Thomson), is responsible for defining the needs of the companies and evaluating the architecture in terms of those needs. On the components end, Inmos is leading the task force in charge of designing the architecture. Siemens is coordinating the applications task force, and Olivetti the one on standards and accounting.

Boxed Material: Nothing Official Before the Summer

As exciting as it is, the OMI project is not yet off the ground, and as even Pierre Aigrain, head of the OMI task force to the Brussels Commission, admits, it should not start officially before the summer. OMI, which for now is one of the specific projects of the European program coordinating the Community's technological efforts in the years 1990-1995, still must be approved by the Twelves' ministerial cabinet. After that, the details will still need to be worked out and the bid invitations published. Part of the work is already in a very advanced stage. Yet no contracts are expected to be signed before the end of the year. The consortium, which is a combination of the large European companies involved (SGS-Thomson, Thomson, Bull, Siemens, and Olivetti, among others), wrote the proposals submitted for approval to the cabinet. They are described by Pierre Aigrin as useful, for the microsystems that form a large part of the complex CLs (logic processors) are today an American preserve. The proposals are not only useful, they are possible, because a certain expertise has grown up in Europe with two types of microsystems: specific microprocessors, with INMOS's Transputer and Acorn's ARM, and microcontrollers for dedicated control. Not to mention the expertise acquired by Philips, Matra-MHS, and Siemens under their licensing agreements with Sun for the Sparc and Mips for the R3000. In any event, according to Pierre Aigrin, there is enough willingness to cooperate among the companies to make the project possible. Especially since, if appropriations are needed, they would not be incompatible with the available sums. The parent program, which has been definitively adopted, involves 1,350 million ecus (9,450 million French francs [Fr]).

If all goes well, then, there will be an OMI, and not an EMI—European Microprocessor Initiative—as originally planned. For the goal is not to make product lines for Europe, but to enable European companies to capture a significant share of the world market.

French Submarine Program Manager Discusses Triomphant

91WS0184B Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 90 p 15

[Article by Alain Perez: "He Is Meeting the Challenges of the 'Triomphant'"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Pierre Quinchon heads one of the most complex programs [in France]: construction of the new-generation nuclear submarine.

"I am extraordinarily lucky." Pierre Quinchon has everything an engineer could want. At the age of 38, he is heading up the national Navy's, and probably France's, most complex program: construction of the Triomphant, the first new-generation missile-launching nuclear submarine (SNLE-NG). "I must bring it out on time, with the planned features, and without running over the budget by one franc."

For this Ecole Polytechnique graduate of the Naval School, there is no lack of challenges to be met. First of all is the challenge of the performance of the ship, which is the keystone of France's dissuasive force: with a sound volume lower than ocean bottom noise, the Triomphant will be a model of silence. "At first, that seemed quite ambitious. But now we are sure to achieve it. The sea trials will be the judge." The second constraint involves the construction of a 12,500 metric ton craft, in sections.

Nearly 3,500 production personnel and a design and engineering department of 500 specialists are at work in Cherbourg at the Triomphant shipyard. "In our business, we don't make prototypes. Studies continue while construction is going on. The first one in the run has got to be the right one." The third challenge is technology. "Our manufacturing techniques today are closer to aeronautics than to traditional shipbuilding. Putting together the Triomphant requires 10 times more accuracy than nuclear boiler construction."

Everything on the Triomphant is new: new steel with high elastic limits, silent pumps, rotating machines mounted on magnetic bearings, and a hull shape that reduces water-flow noises. It is the first in a series of six vessels that will replace the current submarines of the Redoutable family. It will measure 138 km in length, and will have a diameter of 12.50 meters, 50 km of pipes, and 300 km of cables. It will be launched at the beginning of 1993. Altogether, it will mean close to 10 years of studies and nearly 20 years of work guaranteed for the Cherbourg shipyard. "We have been making submarines here for a century. There is a great deal of on-the-job training, and we evolve as the techniques do. When I first got here, there was no automated welding."

Pierre Quinchon is a born submariner. At the age of 25, he joined the Naval Construction Directorate. He started by doing maintenance on the nuclear submarines then in service. At the beginning of the eighties, he was part of the team that did the first sketches of the new-generation SNLEs. "The Americans were already moving in that direction, but nobody helped us. French manufacturers made a colossal investment of brain power in noise reduction. We made a much quieter ship, which also dives much deeper. These technologies are not accessible to everyone."

Awaiting the great day launch day, Pierre Quinchon does his accounts over and over. "The initial estimate has not budged since 1987. The Triomphant will cost 9.5 billion French francs [Fr], corrected for industrial inflation, which is about 5 percent a year. National defense is also a component of the budget. If I up my estimate, the other programs will suffer. I am deeply convinced that I am making good use of the taxpayer's money." Pierre Quinchon's mission will end in 1994, when the Triomphant will be declared ready for service. Someone else will take his place to finish construction of the Temeraire, the second SNLE-NG scheduled to be put into service three years later. But Pierre Quinchon is already interested in the next generations of submarines, which will have to reach depths of around 1,000 meters to remain invulnerable. "We have reached the absolute limit with the HLES 100 steel. The titanium option is also inadequate. If we want to go much deeper, we will have to skip a technology and move directly to a composite-material hull."

Germany's Parsytec To Build 1.6 Teraflop Computer

91P60149 Munich COMPUTERWOCHE in German 12 Apr 91 p 25

[Excerpts] Parsytec, a manufacturer of computers with parallel processing architecture, is tackling a European teraflop computer. Project startup is slated for the first half of 1991. By 1993, a parallel processing system should be built which, incorporating 65,536 32-bit processors, will represent the largest multiple instruction multiple data (MIMD) architecture to date. Plans call for a water-cooled computer with homogeneous MIMD structure, designed for a peak performance of 1.6 teraflops [passage omitted]. A consortium with European partners, including transputer processor manufacturer INMOS among others, was created for the project. Parsytec has overall charge of the project and is implementing it as a non-profit venture.

Germany: Juelich Research Center Increases Number of Neural Net Synapses

91MI0241 Duesseldorf HANDELSBLATT in German 12 Mar 91 p 30

[Excerpts] Dr. Gregory Kohring recently set a world record at the Very High Performance Computer Center (HLRZ) at the Center for Cooperation in Research and Application (KFA): the simulation of neural networks with 100 billion computations per second, computed on the CRAY Y-MP 832 very high performance computer. A year's programming work was thus crowned with success.

Neurons are nerve cells in the central nervous system. The human brain has about 1 quadrillion (10^{15}) interlinked neurons.

The first part of Dr. Kohring's work entailed collating theory with experiment. [passage omitted]

The Juelich program simulated neural systems with up to 100,000 neurons and 10 billion synapses between the neurons. Only by studying systems of this size will it be possible to ascertain clearly to what extent approximate mathematical calculus lack physical bases and associative memory properties. As regards interneuron synapses, this system was about 900 times greater than all previous experiments.

The second part of the project involved seeking the most effective method provided by computer technology in its present state of creating neural networks. To this end, Dr. Kohring used what is known as the Willshaw model, in which the neurons and synapses assume the values zero or one only, unlike the Hopfield model with its real number values. This model is ideal for current computer technology.

Multispin coding was used to achieve simulation speeds of up to 164 billion computation evaluations per second.

By comparison, other models can simulate only 500 million computation evaluations per second.

The Juelich scientists believe that these results represent an encouraging step forward on the road toward creating artificial neural networks.

Italy: Nuclear Physics Institute Designs Supercomputer Prototype

91MI0210 Milan ITALIA OGGI in Italian 12 Feb 91 p 18

[Article by Francesco Festuccia: "The Super 'Made in Italy' Supercomputer"]

[Text] When you look at it, the "beast" does not even impress you. It is a small, "almost" transportable, quadrangle. Yet it is the fastest supercomputer in the world: a billion operations per second (in its final version which will be ready in July 1992; it currently "limits itself" to 400 million operations per second). A beast with a graceful and hardworking name: it is called "APE [Bee] 100" (Array Processor Experiment) and its likeness to the insect was clearly visible in the rooms of the Faculty of Physics at La Sapienza University in Rome. A small paper bee, a smart reminder of the all-Italian creativity that led to this result. Professor Nicola Cabibbo, president of the INFN (National Institute of Nuclear Physics), a public institute that promotes, coordinates, and finances research in the field of nuclear and subnuclear physics) proudly presented it yesterday. The researchers, including the INFN president, designed and constructed APE 100 to help solve the most complex problems in atomic physics.

When the project is finished, APE 100's cost will be 11 billion lire, four billion less than the price of a commercial supercomputer (approximately 15 billion lire). But why has this university institute equipped itself with a structure that is so advanced and complex that, according to Cabibbo, its only other rival in the world is at Columbia University?

First, to be self sufficient in a field where "hourly" commercial computing costs are very high, and also to develop something that is specifically designed for use in physics. In fact, supercomputers have now created new and important prospects for the development of scientific research. Their fundamental contribution is their ability to simulate the behavior of complex causal systems. According to experts, numerical simulation has become an essential instrument especially when equations governing a given causal system cannot be solved directly either due to their complexity or difficulties of a mathematical nature.

Prof. Cabibbo attempted to provide a detailed explanation of the reasons that led to the launching of the APE project, which has been under development since 1984: "In basic research, numerical simulations have revealed themselves to be essential in the study of quarks, the ultimate components of matter, which obey laws—quantum chromodynamics—and for which normal mathematical methods cannot be used except for a few special cases. It was precisely the needs of this branch of basic research that induced our group to build its own line of supercomputers."

APE was developed to solve problems in atomic physics (in particular to simulate the behavior of the particles that make up the proton, so that the validity of mathematical theories could be demonstrated on the atom), but its applications may be extended to other scientific and technological fields. For example, according to Nicola Cabibbo, to simulate the behavior of the atmosphere in meteorology, study turbulence around a moving vehicle or airplane, or even reproduce biological phenomena such as the formation of proteins in cells.

The possibility that other organizations, be they public or private, can use the supercomputer should not be excluded either, nor it is unlikely that the institute will produce an example of the "beast." Other developments are foreseen on the crest of a European project for the development of a 1 Teraflop (one trillion arithmetic operations per second) computer. The Italian APE group declares that it is the only one in Europe to possess the know how needed for an undertaking of this kind. Another possible use of this initiative is in the design of cost-effective machines with the power of present-day supercomputers. Machines of this kind could be widely used in the field of pure and applied research. Today, using current technology, APE experts can already assemble a computer with the performance of a Cray 1 supercomputer, inside the :"chassis" of a personal computer.

Germany: AI Achievements of East Reviewed

91AN0260 Amsterdam COMPUTABLE in Dutch 1 Feb 91 pp 47, 49

[Article by Gerard Kuys: "Continuation of Projects Requires Cooperation With Wealthy Partners; Several of GDR's AI Research Programs of Interest to the West"]

[Excerpts] The unification of former East and West Germany has also put the integration of the two countries in the field of computers on the agenda. Everything relating to automated data processing has to be adapted not only to larger-scale operations but also has a different structure. However, those who had expected to find the automation industry in the former GDR in a hopeless state, ready for rapid exploitation and wide open for the current international standards of "the West," were mistaken. In some cases, the relative isolation and the restricted availability of technical resources created the very conditions that led to remarkable achievements. One example of this is artificial intelligence (AI).

In the former GDR, state authorities and party leadership attached great interest to fundamental research in the field of computer sciences. The strategic importance

of developments in this area was obvious and efforts were made to keep up with "the West." [passage omitted]

Provincialism

Since in less than a year the former GDR's AI institutes saw themselves stripped of financial resources because of the collapse of the East German government infrastructure, they were forced to seriously investigate new opportunities. According to Dr.D. Koch [director of the Institute for Artificial Intelligence (IFKI)], scientific institutes in the GDR have a lot to learn about marketing because up until last year they had never had to worry about it.

"American and European scientists have learned how to sell their scientific achievements to officials and companies," says Koch. "The prime concern of GDR scientists now is to ensure the continuity of their research, while at the same time they have to make inroads in the international market. However, for the last 30 years they have operated according to totally different criteria; for example, someone who published an article in a Western scientific magazine aroused suspicion in our country. These kinds of situations led to a form of provincialism, which does not mean that our scientists were worse or less original than others, but that they had difficulties keeping abreast of the state of the art in research.

Now East German AI researchers generally try to accommodate their major projects in joint ventures with financially strong West German institutes or companies. Sometimes this means abandoning areas of research that have become outdated as a consequence of the GDR's whimsical AI policy.

Applications

Koch believes that good opportunities for East German AI research can be found in the field of expert systems. Traditionally in the GDR, close ties have always existed between scientific research and applications in industrial processes. This has contributed to the development of several more practical applications.

By way of example, he mentions the expert system that has been developed by his institute for protein engineering. "We have been involved in molecular biology research for years," says Koch. "We have combined this with our traditional area of research into learning algorithms for computers. By formulating rules on the basis of measurement data relating to proteins in a data base, we expect to obtain a better starting point for the application of quantitative geometrical methods, which will enable us to predict the three-dimensional structure of proteins. In view of the increased international sensitivity with regard to biotechnology research, many believe that this approach will offer significant and promising opportunities."

However, some AI projects have been hit by the crisis which the East German software industry is going through as a consequence of the unification of Germany. For the past 15 years or so, research in the former GDR has been focused on AI applications such as image recognition and natural language processing. This has led to various useful results, but the continuation of these activities is now in jeopardy.

Exodus

AI research has for instance produced systems that can be used for industrial processes and for CAD/CAM (computer-aided design and manufacturing). It has also produced prototypes of a natural language interface for data bases which have attracted international attention. However, since as of 1985 existing Lisp systems could no longer meet requirements and new systems could not be acquired, the project lost momentum.

An expert system shell, Xforce, has been developed which was especially designed for language and image processing. Apparently, Xforce offers good solutions for automated programming in such languages as Fortran and C and in dBase. A commercial version has not been developed yet. The reason for this is that many East German Xforce programmers have left for West German employers.

Another center of East German AI is the Technological University of Leipzig. Here, recent research has been devoted to upgrading decision support systems (DSS) with AI-based functionality. Especially the reasoning capacity—drawing conclusions from data that are not numerical but qualitative—opens up perspectives for new applications of decision support systems.

Inventory Control

To give publicity to the results of their work, researchers of the Technological University published a series of articles in the Western magazine DECISION SUPPORT SYSTEMS. One of these, authored by Prof. D. Ehrenberg of the Faculty for Corporate Management, describes an expert system that was developed in Leipzig. It is a system for inventory control and logistics management. This is a typical subject for an expert system because of the clearly defined knowledge domain and the often complex decision patterns.

The primary advantage of AI technology in comparison with traditional DSS technology is, according to Ehrenberg, the fact that expert systems are able to justify their line of reasoning. With traditional decision support software, this was only possible to a limited extent or not at all. Moreover, said Ehrenberg, conventional DSS systems could not handle uncertainties.

Logistics management systems typically have to deal with numerous variables that cannot be entered into a model in advance. For this reason, Ehrenberg has developed an expert system in Prolog, dubbed Exbest, that via a series of rules of thumb contains all knowledge needed for efficient inventory control.

Evaluation Report

Systems like Exbest do not represent a technological breakthrough in the field of expert systems. In the Netherlands, for example, expert system shells are being used for logistics management and DSS systems are being upgraded with AI functionality.

Nevertheless, there is still a great potential in the former GDR for the development of innovative systems, as has been demonstrated by the self-learning system for protein engineering and the Xforce shell. It is now up to East German AI researchers to determine, through intensive contacts with companies and (university) research groups, which aspects of their scientific work are of interest to the Western automation market and should consequently be promoted. The IFKI has already drawn up an evaluation report to meet this need. The authors, Koch and P. Florath, have determined three main areas in which East German AI might be successful: the development of basic AI software (the Lisp project as part of Babylon), further research in the field of logical programming, and the development of technologies and instruments for knowledge acquisition.

Opportunities

According to the report, research in the field of logical programming should in the first place concentrate on "the quality of the different logical systems with a view to knowledge and information processing." The following objective is "the theoretically underpinned and nonconflicting integration of methods for declarative and functional logic programming with object-oriented knowledge representation and deduction with the aid of data bases."

As far as knowledge acquisition is concerned, IFKI believes that the automation of knowledge acquisition is essential. Learning algorithms for computers will be the main research area. "Learning algorithms are no longer considered to be isolated systems," notes the IFKI report, "but components of complex knowledge-based systems. The specific characteristics of the complete system therefore determine to a great extent the nature of the learning algorithms applied."

Besides model-driven applications, IFKI wants to concentrate on explanation-based applications. This is of particular interest in cases where explanations of symptoms are based on in-depth knowledge and knowledge derived from practical situations. Great opportunities lie ahead especially in chemical applications where new rules are established by using chemical reaction data bases. Now, everyone is on the look-out for affluent organizations that are interested in joint ventures or similar formulas.

DEFENSE INDUSTRIES

France: Selections From Defense R&D Report Published

91WS0175A Paris INDUSTRIE ET TECHNIQUES in French 21 Dec 90 p 84

[Article entitled: "Science and Defense"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] The Directorate of Technical Research and Studies of the General Weapons Delegation regularly makes available certain research findings to manufacturers. Here is a selection from the latest publications.

Micro-Wave-Absorbing Materials

These materials are made by synthesizing core-shell type, thermoplastic, film-forming, encapsulated, conductive polymer latex, in which the core of the particle is the conductive polymer and its ring is made of film-forming polymer.

The method produces a conductive polymer "paint" that can be applied to any surface through plating or electroplating.

The material is fabricated in two distinct steps: first, the stabilized conductive polymer is synthesized in an aqueous solution; then the p-conductor particles encapsulated by a film-forming polymer. The materials are easy to use, show good resistance to thermal dedoping, and have satisfactory di-electric features, making them good candidates for micro-wave absorption. Reader Service 9139

Conductive Organic Materials

This study deals with the solid-state fabrication and the characterization of new types of conductive organic composite materials. The latter are made from initially insulating products, using a solid-state charge-transfer reaction between materials that give off TTF (Tetrathiofulvalene) electrons, a simple TEA (TCNQ) salt or a TEA (1) iodide, and electron accepters such as TCNQ (tetracyanoquinodimethane) or TEA (TNCQ)2 (a double triethylammonium salt.) The electric and magnetic properties of the solid-solid reaction products were characterized. Also considered were: aspects related to the percolation of electric conduction in reactive insulator-conductor mixtures; aging problems of the materials; the physical-chemical processes of charge-transfer reaction in the solid phase. Reader Service 9138

Report on Making the Generalized Convoluter

The basic aim of this study was to provide research teams working on the Hecate project with real knowledge of the integration of on-board rapid image-processing architectures. The generalized convolution circuit is used to perform the operation of the same name, whose purpose is to move a mask around on the image, at sensor operating speed, and to perform two operations in

a row on the pixels in the mask. A systolic architecture was selected for the combinations of generalized convoluters, in order to move toward integrated sequence cellular sets. Reader Service 9141

Laser Treatment of Titanium Alloy

This study demonstrates the possibilities for using continuous lasers for reactive surface treatments of titanium alloys. The treatments consist of nitride hardening and cementing of solid state alloys in the presence of gas, either by using a predeposited layer or by injecting particles in the molten bath. The micro-hardness of the layers can attain values of +2000 Hv. Reader Service 9144

Thermoplastic-Thermsettable Combination

This study aimed to contribute to a better understanding of the optimal conditions for incorporating a thermoplastic plastic into a duroplastic, so as to combine the good mechanical properties of thermoplastic resins with the good thermal properties of thermosetting resins.

Both PEI polyetherimide-based or PES polyethersulfone-based mixtures and dicyanate resins were fabricated in solution form, and were used as AS4 carbon-reinforced composite material matrices.

The toughness of the different materials fabricated was characterized by determining their crack growth energy, which reached 500 J/square meter for systems containing 20-percent PEI. Reader Service 9140

Treatment of Materials With Repeated Laser Pulses

Pulsed CO_2 lasers can effectively transfer high amounts of energy to materials, in a wide range of densities. Through plasma-induced processes, a clearly thermomechanical energy transfer is effected. The author reports on recent measurements undertaken at the Saint-Louis Institute with a pulsed CO_2 laser. The laser used has average power of 2 to 2.8 kW, emits pulse strings with energies of over 20 J (up to 28 J) per pulse, and has adjustable repetition rates up to 100 Hz.

The studies conducted so far with this laser deal not only with the thermal and mechanical behavior of highly reflective metals, but also of highly absorbant di-electric materials. Reader Service 9143

ENERGY

Germany Funds Joint East-West Power Engineering Research Projects

91MI0213 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT INFORMATIONEN in German 29 Jan 91 p 2

[Text] The Federal Ministry of Research and Technology (BMFT) is subsidizing joint projects between eastern and western German firms to give efficient research groups in the new Laender a head start in the high technology area of exploration, extraction, and conversion of crude petroleum and natural gas deposits that have proved impossible to exploit to date. Funds totaling approximately 13 million German marks [DM] have been earmarked since the beginning of the year for the institutes and companies taking part in several of these joint projects. Seven individual projects in special areas of exploration, extraction, and conversion of unconventional hydrocarbons are being subsidized. The term "unconventional hydrocarbons" in this context means crude petroleum or natural gas that cannot be extracted or exploited with the technology currently available.

Joint projects between the Federal Institute of Earth Sciences and Raw Materials in Hannover and the Leipzig-based Central Institute of Isotope and Radiation Research and between Potsdam Central Institute of Geophysics and the Juelich Research Center are investigating the historical origin and deposition of petroleum and natural gas in the strata of the earth. In addition to the geological aspects of exploration, such as intercalation and sedimentation in rock and the structure and composition of the gases and oils, the three-dimensional configuration of the deposits and scientific methods of mineral diagenesis, geochemistry, and isotope physics will be studied.

Magdeburg Technical University's scientific work on applying fluid mechanics principles to the design of centrifugal pumps for the underwater transport of gas, water, oil, and solid matter mixtures, a problem that has not been solved to date, is part of a major western German joint project conducted by the GKSS [Society for Nuclear Energy Exploitation in Naval Engineering and Navigation] Research Center in Geesthacht in conjunction with industry.

This project sets out to develop an efficient, environment-friendly system of transport from offshore drilling platforms to the mainland. A research team from the Petroleum Pipeline company, Schwedt/Brandenburg, and the German Scientific Society for Petroleum, Natural Gas, and Coal is carrying out similar studies on safety in petroleum and natural gas pipeline transport systems. The team is already testing a new generation of diagnosis systems with sensors working on modified principles.

Another group of joint projects has arisen in coal upgrading, a traditional German research area. In addition to a special study of tar formation mechanisms in the lignite mined in eastern Germany, which is being carried out by the German Fuel Institute, Freiberg, and the DMT Research and Testing Association, Essen, this primarily involves basic studies and pilot experiments on liquid phase hydrogenation of heavy oil residues and natural bitumen, both alone and combined with lignite. These studies are being carried out jointly by the Chemical Engineering Plant Construction company in Leipzig-Grimma, the Institute of Chemical Engineering in

Berlin, and the Coal Hydrogenation Association in Saarbruecken. They cover both environment-friendly exploitation of petroleum residues and the utilization of considerable reserves of heavy, otherwise unexploitable, natural bitumen in the USSR.

Additional information about the research work mentioned above is obtainable from: BEO, Research Manager, Dr. Richter-Sandvoss, Box 19 13, 5170 Juelich.

FACTORY AUTOMATION, ROBOTICS

France's SAF, Japan's Daihen Build Welding Robot

91WS0151B Paris L'USINE NOUVELLE/ TECHNOLOGIES in French 13 Dec 90 p 59

[Article by Alain Dieul: "Productor, the Omnidirectional Robot"; first paragraph is L'USINE NOUVELLE/ TECHNOLOGIES introduction]

[Text] The first of its kind to be developed in France, and the result of a joint effort by SAF [French Welding Company] and Japan's Daihen, it positions itself in all directions to weld workpieces.

The zone accessible to the arm of almost all welding robots has the form of a half-moon in the vertical plane. This characteristic presents no problem in the case of materials-handling or painting robots. But it is not ideal for welding, which often requires access to the rear of the workpiece. Classic robots must therefore be equipped with a positioner that changes the orientation of the workpiece in relation to the welding head. To deal with this, SAF, jointly with the Japanese company, Daihen developed Productor. This robot, with its five or seven axes, has practically a 360-degree zone of access.

To design the structure of this robot, the Japanese started from a case study involving 2,000 Mig/Mag arc welded workpieces. They succeeded in obtaining the mechanical characteristics specified by SAF, by resorting to the most recent technologies. For example, using alternating-current servomotors. "This type of power system provides the robot with very high acceleration capabilities and needs no maintenance whatever, since it contains no brushes," says Jean-Guy Lecart, SAF's chief of production. Furthermore, each of Productor's axes is equipped with an absolute coder that does not require a return to zero-position at each new application of accelerating voltage.

From the electronic standpoint, the main R&D effort has gone into improving reliability. Optic fibers provide noiseless, interference-free communication links between the welding head and the control rack. The design of specific hybrid circuits has also increased overall reliability by reducing substantially the number of electronic components.

The development of such a robot was unthinkable in France: The Japanese sell more than 200 units annually. By comparison, SAF's market is limited to some tens of robots.

Through its cooperation and, above all, the exclusive import contract it has signed with Daihen, however, the Cergy-Pontoise-based company has been able to top off its product line with a high-performance robot. Productor is now the centerpiece of a complete welding island capable of adapting to the requirements of each individual case.

Trends in Laser Applications Analyzed

91WS0164A Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 91 pp 25-26

[Article by Claude Gele: "The Omnipresent Laser - Sheet Metal Manufacture"]

[Text] Preparing for the forthcoming arrival of Japanese laser manufacturers: That is the impression one got at Essen (6-10 November) in talking with European builders of automated sheet-metal workshop machines embodying power lasers. Fanuc alone delivered 1,200 CO_2 lasers last year. This figure is to be compared with 250 to 300 lasers manufactured by each of the two European leaders across the Rhine: Rofin-Sinar and Trumpf. Another concern is prices: Fanuc is offering laser sources at 30 to 50 percent lower prices! For the time being, the Japanese are selling their lasers only to system integrating companies, for use with robots and flexible workshop cells (Mazak) and with punching and nibbling machines (Amada), and are not currently present in a marketing capacity in Europe. Last year's acquisition of Lumonics, the British-Canadian group and world's leading manufacturer of YAG [yttrium-aluminum-garnet] power lasers, by Sumitomo Heavy Industries, however, suggests the possibility of a forthcoming offensive....

Dominated not so very long ago by the Americans, the laser industry has recently made Germany its main center of activity. Siemens controls Rofin-Sinar, which acquired Spectra-Physics' power laser activity as well as Laser Optronic GmbH for marking. W-B Laser is a new company, based in Munich, that carries on the activity of Photon Sources (80 CO_2 lasers per year, up to 2.5 kW). Valfivre (ex-Heraeus) is offering a new 8-kW source. Trumpf has become the second largest European supplier, with a line of CO_2 lasers, 750W to 6 kW, with TLF high-frequency control, enabling continuous, microprocessor-regulated power output. This firm (3,000 employees worldwide and 62 percent of its annual revenue from exports) advanced its ambitions at Essen with a world's first: A compact 5-kW CO_2 welding laser. It uses TLF Turbo technology, which has only been available heretofore up to 1 kW. The beam is retracted on the square around a radial turbine, reducing its "footprint"

to approximately 1 square meter. It is the world's most compact laser in this power output range, facilitating its integration into machines.

To complement its Laserpress 240 and 260, which are composite (combined mechanical and laser punch) machines, Trumpf has brought out a Lasercat punch press of lesser capacity (1.5 m x 1.5 m) incorporating a 1-kW Turbo CO_2. It punches through a sheet-metal thickness of 6.4 mm. Another innovation is a 5-axis multipurpose robotized laser cell, the TLC Lasercell, for sheet-metal, tubing, and sectional work. Some 15 of these cells have already been ordered, three of them for the French market. Their price: 3,5 million francs.

Innovative Technique for Trueing Up Metal: Laser Shaping

This flexibility strategy is also being pursued by the two Swiss manufacturers Laser Work and Bystronic Laser. Laser Work, an Agie group subsidiary, is offering an LW 2040 flexible cutting, punching and stamping center equipped with a 1.7-kW Photon source. It is a modular and extensible machine with a palletization system for the welding and cutting of sheet metal and 3-dimensional workpieces. Like Trumpf, Bystronic (450 employees) manufactures 1.5-kW CO_2 lasers for its flexible sheet-metal machining installations, notably Byflex, a general-purpose cutting and welding machine, and Bysmall, a small (2.5 x 1.5 m) punch press with a bed equipped with retractable segments for supporting sheet-metal. Bysort is a fully-automatic, robotized, dual-press cutting, punching and stamping installation. The robot feeds the sheets, positions them on the laser press, then removes the punched and stamped workpieces, and stacks them on a pallet in a CAD [computer-aided design]-programmed pattern, before removing the sheet-metal scrap. Adige, the Italian manufacturer, represented in France by Scitec, based in Guebwiller, exhibited a TT 650 machine specially-designed for the laser machining of tubing.

Polish researchers of the Institute of Fundamental Technology Research in Warsaw exhibited an innovative technique: Laser forming, in which metal is trued up by means of a 2.5-kW CO_2 beam which scans it and controls the amplitude of deformation through a sensor and feedback loop. Professor Bogalz, who heads this research program, indicates that applications are currently being tested, particularly for setting the teeth of circular saws.

Italy: Pirelli Develops Automated Tire Manufacturing System

91MI0224 Milan FATTI E NOTIZIE in Italian Feb 91 p 5

[Text] An advanced programming system for batch production is about to be installed in numerous Pirelli tire plants across Europe. It is called the BIS [Banbury Information System] system, a personal computer software developed over a two-year period by a team of specialists from Pirelli's PCP [Pirelli Tire Coordination] and PI [Pirelli Computers] divisions and certain operational units in its tire division. The BIS project was launched with a decisive financial contribution from the EEC within the framework of the ESPRIT (European Strategic Program for Research and Development in Information Technologies) program.

As Giorgio Basaglia, head of industrial systems development for the PCP operations management division and the BIS work group, explained: "The EEC launched the 10-year ESPRIT program in 1984. The main goal of the program is to promote the development of information technology in Europe through cooperation between companies and universities. Pirelli began to participate in ESPRIT in 1984 through a consortium of companies (among which Philips, AEG, and BIC) and prestigious universities that presented project EP932 for the development of expert systems for production supervision. PCP, SPP, and later, PI participated in this project in which Tiziano Narni and Amos Carlini played a leading role.

"The results were impressive," Basaglia continued "and project EP932 evolved into project EP2434, oriented toward the development of expert systems for maintenance and quality and production control, within the consortium and similar structures. The EP2434 project, involving PCP and PI, evolved into numerous Pirelli projects, including the BIS project, in collaboration with other operational units in Europe thereby developing considerable know-how and expertise at the European level."

But what is BIS? Marco Guida, head of the expert systems group at PI explains, "BIS stands for Banbury Information System. The Banbury mixer is as tall as a three story building, costs approximately ten billion lire, and is used for batch production. The batch room is a vital center in a tire manufacturing plant. Here, rubber combined with chemical ingredients is transformed through a series of successive processes into batches, which are the basis for manufacture."

"Production planning in a batch room," Basaglia continued, "is based on the concept of exploiting the Banbury mixer's production capacities to the utmost by combining a series of conditions related to materials, processes, manpower, and machinery. It currently takes the production programmer of a batch room about four hours to draw up a one-day production program manually. Then, as a result of circumstances beyond his control, it is no longer easy to modify. However, the problem is not only the time involved: Given the great quantity of factors that must be taken into consideration, the production programmer is inclined to consider only a subset of these factors, which may vary according to the person, the plant, or circumstances. The result is a possible inconsistency in program quality. Two existing systems, developed with traditional computer methods, have a limited degree of automation, leaving the programmer with a considerable work load."

At this point, an attempt was made using expert systems technology. Luca Majocchi, head of advanced manufacturing systems at PI, stated: "BIS evolved from three main areas of activity: experience with industrial expert systems resulting from the EP932 project, theoretical research on the production planning problem, and very close collaboration with the users. In practice, although specific PI methods were used, these areaas of activity defined the specification which was successively revised in the factory before and during the development of the system."

"The users who comprised the work group," Basaglia explained, "were chosen on the basis of criteria that would guarantee 'quality' specifications and that were easy to generalize. The criteria included the good knowledge of the problem, different nationalities (UK, Spain, Turkey, and later Greece) with differing production methods and styles, and participation in previous attempts to create a traditional system.

"The result was BIS," Basaglia continued, "a single system for all the plants involved in development, but flexible and easy to customize."

And what about performance? "Very good," stated Guida. "Even though the hardware is not extremely powerful (a 386 personal computer is used), the daily production program is created in about a minute (once the data has been prepared) and it is completely automatic."

What about the economic benefits? Basaglia answered: "Apart from reacquiring efficiency due to improved time management, the quality of the program is absolutely constant and all the variables are always judged according to the same standard."

When will BIS appear in Pirelli's batch rooms? Basaglia answered: "The system may be extended further than the four pilot plants."

Therefore, the project was successful. "Yes," Basaglia concluded, "but in more ways than one. Apart from being an excellent product which came into being in a European context by making the best possible use of EEC funds, BIS is a brilliant example of collaboration between the group's operational units and central units (PCP and PI)."

"Like other ESPRIT projects," Majocchi added, "this has enabled PI to consolidate its expertise on expert systems applied to manufacturing problems, so much so that we also became involved in ESPRIT projects outside the group."

At least on the level of participation in EEC projects, the project seems to have been well accepted. Activities designed to present new projects for the third phase of ESPRIT beginning in 1991, are already being defined. PCP and PI will still work together and along the lines of the group's recently-established coordination.

Italian Automated Machine Tool Manufacturing Discussed

91WS0164B Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 90 p 27

[Article by Claude Gele: "Italians, Champions of Flexibility"]

[Text] Despite signs of a slowing down of production, the Italian machine tool industry appears to be in good health and is restructuring with a European outlook. This is the impression conveyed by the BIMU [Biennial Machine Tool Fair] in Milan (19-25 October), at which some 1,500 firms exhibited, most of them Italian. Production by the latter is running at an estimated 5,100 billion lire for this year, versus 3,920 billion in 1988, up 15 percent as compared with the worldwide average of 12 percent. Exports, representing approximately half of total production, are up 20 percent, and the sector's trade balance is positive by more than 1,000 billion lire. Industry experts point out, however, that growth of the domestic market has slowed to 15 percent from the 50-percent level of "halcyon years" 1986-1987. "The party is over," they were able to say.

The exhibits of these star performers of the machine tool industry, and particularly in the field of flexible manufacturing systems, bear out their intent to land in Europe as world-class groups. The Mandelli group displayed its expertise in automation. It exhibited a scale model of the Case-Poclain flexible workshop at Saint-Dizier (15 Regent machining centers and four multiple-spindle machines, to which are being added nine machining centers being supplied to Renault Automation for the second Case-Poclain workshop). It also exhibited its new line of machining centers and the machines of the four companies [as published] it acquired around the beginning of the year: Innse (large milling machines, lathes, and machining centers), and SAIMP (grinding machines and flexible cells). "Between now and 1992," says Giorgio Conte, vice president of the group, "we intend to become the number one European supplier of machining centers and flexible systems." Currently, it ranks fourth in Europe, and 15th worldwide, with 1,600 employees and an annual revenue of $260 million.

Num Controls Servomac, Italian Number One in Axis Drive Motors

Olivetti, now merged with the Anfina group under the name of OCN-PPL, exhibited a flexible cell consisting of two Horizon 550 machining centers controlled by a Multibrain data processing system, a Polaris 2 turning center with robotized feed of workpieces, and a new 48-tool horizontal lathe with palletization system. This machine has a capacity of 400 mm^3 and an original architecture: the workpiece is held horizontally. Specializing in machining centers and palletization systems, MCM (120 employees) exhibited its Connection Mirror System flexible cell, introduced in May of this year and consisting of two machining centers installed on either side of a store of 200 tools served up by a fast robot. Four

of these cells (price: 7 million francs each) are currently being installed in Italy for Fiat subcontractors and for Duplomatic, a Milan manufacturer of chucks. Comau's rather modest exhibit featured the Smart laser-robot, equipped with a 5-kW Trumpf source and an all-new numerical control. It also featured the Huron-Graffenstaden line of high-speed machining centers for the automotive, aeronautical, and shipbuilding industries. Jobs, with 180 employees, has strengthened its breakthrough in high-speed machining centers for the automotive, aeronautical and shipbuilding industries, notably with a new model: Jo'mach 123.

One of the big events was the announcement of the takeover of Servomac, Italy's number one in axis drive motors and variable-speed drives, by France's Num. Telemecanique's subsidiary is thus bracing itself to take on Siemens and its major Japanese competitors, Fanuc and Mitsubishi.

LASERS, SENSORS, OPTICS

Swiss-Developed Sensor Measures High Voltages Non-Electrically

91WS0159A Duesseldorf VDI NACHRICHTEN in German No 3, 18 Jan 91 p 10

[Unattributed article: "Quartz Disc Measures Electrical Voltage"; first two paragraphs VDI NACHRICHTEN introduction]

[Text] Daettwil, 18 Jan (VDI-N)—Laser light registers expansion. The process is effective up to high electrical field intensities.

A new type of sensor permits non-electrical measurement of electrical voltage for the first time: A tiny circular quartz plate changes diameter as a function of field intensities, whose exact value is determined by laser light through an optical fiber wound around the plate. The "fiber optic voltage sensor" is particularly suitable for high voltage technology.

Until now measurement of high electrical alternating voltages has always been within the domain of inductive transducers. These are essentially transformer coils made of copper wire which deliver a reduced, readily measurable signal as a measure of voltage. Now, Klaus Bohnert and Juergen Nehring, two physicists at the Asea Brown Boveri (ABB) research center in the Swiss city of Daettwil, have engineered a voltage sensor which breaks with the copper tradition and takes an entirely different approach using a combination of dielectric materials.

The point of departure for the discovery was the fact that conventional voltage sensors in high voltage technology, for example, in outdoor substations or in generators, are in many places affected by interference from strong electromagnetic fields and that the signal must be transmitted over enormous variances in electrical potential and often over long distances. Optical fibers, whose glass material is insensitive to electromagnetic interference fields, presented a good alternative to copper wire for the transmission of the sensor signals. But what could be used instead of a transducer as a sensor?

Bohnert and Nehring concentrated on the reversal of the piezoelectric effect: When placed in an electrical field, certain crystals change their dimensions as a function of its field intensity. The reason is that electrical charges shift in the crystal under the influence of the field, which in turn lengthens or shortens the crystal in specific directions. Among crystals with such properties, the ABB researchers opted for quartz not only because of its mechanical and chemical stability. The piezo effect in quartz also has relatively little dependence on temperature, and, last but not least, high quality quartz has the advantage of being obtainable at reasonable cost.

That left the question of how to measure the change in length of the quartz using optical fibers. To solve this problem Bohnert and Nehring first selected the orientation of the crystal axes in the quartz disc such that in an electrical field the circumference of the disc increased or decreased depending on the field direction. Thus, the sensor responds only to the field component perpendicular to the surface of the disc.

On this basis, the remaining steps are obvious: A few windings of the optic fiber are wrapped around the circumference of the quartz disc; laser light is passed through this, and by means of an optical phase meter, an interferometer, this in turn reveals the change in length of the optic fiber and with it the change in the circumference of the disc. An additional calibration is required to read the field intensity or voltage from the change in length. If multiple quartz discs are stacked on top of each other on a single axis, they add the field in the direction of the axis—a sensor variant of particular interest when the geometric field distribution varies over time.

The finished sensor gives little indication of the years of painstaking work which went into its development. The quartz disc is a tiny circular plate or a ring the size of a very small coin: approximately 10 mm in diameter and a few millimeters thick. The optic fiber has about the diameter of a fine hair. Fields between 1 V/m and 10 MV/m can be measured with accuracy in the thousandths, with the frequency range running from virtually zero, i.e., direct current, to 100 KHz (above that signal distorting resonances are generated in the quartz). The prototype of a complete measurement device for a high voltage substation has passed its performance test in the lab. To make the device suitable for practical use even in harsh environments, a few electronic components still need to be improved and the sensor appropriately packaged.

Bohnert and Nehring envision the use of their now patented tiny sensor primarily in gas-insulated, encapsulated medium voltage and outdoor substations of the power grid, when the lack of sensitivity to magnetic field interference must be taken into account along with the

potential separation peculiar to the sensor design or the limited space requirement. The prospect that the "fiber optic voltage sensor" might increase the reliability of these installations and thus the power supply prompted the National Energy Research Fund (NEFF) of the Swiss energy industry to assume part of the development costs.

MICROELECTRONICS

France: CEA, CNET Sign GRESSI Research Agreement

91WS0191C Paris ELECTRONIQUE HEBDO in French 10 Jan 91 p 41

[Text] The CEA [Atomic Energy Commission] and the CNET [National Telecommunications Studies Center] have signed an agreement extending beyond its current limits the cooperation between their two laboratories that was initially provided for under the GRESSI [Grenoble Submicron Silicon Initiative] GIE [Economic Interest Group]. This cooperation, which originally covered only basic research, will now be extended to research concerned with the development of processes meeting industrial specifications, up to but not including the setting up of production lines. The research undertaken under GRESSI relates to technologies involved in the design and development of integrated circuits with line thicknesses of up to but not exceeding 0.35 microns. Its intent is to prepare the way for the generation of circuits that is to follow that whose production line is to be developed by the Grenoble 92 unit, a joint CNET/SGS-Thomson GIE. The CNRS [National Scientific Research Center] and the universities are associated with the research being done under GRESSI through the GCIS [Silicon Integrated Circuits Group].

At the 21 December general meeting of the members of GRESSI, Mr Verdonne (CEA/Leti) and Mr Bomchil (CNET/CNS) were designated manager and deputy manager, respectively.

French LCD Manufacturers Face Production Problems

91WS0150A Paris L'USINE NOUVELLE in French 20 Dec 90 pp 67-68

[Article by Jean-Pierre Jolivet: "Flat Screens: France Mobilizes"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Though the technological choices have been made, French manufacturers must move to the industrial stage and master the production of large-enough screens at acceptable costs.

Less than a month after Paul Quiles's decision to launch a program to mobilize manufacturers working on display technologies backing videophones, France Telecom is accelerating its detailed inventory of national strengths and weaknesses.

The key to this effort is the investment of 250 million French francs [Fr]. The money will go to help French manufacturers meet the challenge, in the face of Japanese competition, of liquid-crystal flat screens, indispensible in high definition television. But it will also go to help make the transition to the industrial stage. This stage will entail "harmonizing" the efforts of Thomson-LCD, SAGEM (Company for General Applications of Electricity and Engineering), and CNET (National Center for Technical Studies), and even seeking or shoring up European cooperation, especially with Philips, which has already invested 400 million in the technology.

The technological choices have been made. The two French specialists, Thomson-LCD and Sagem, have opted for active matrix screens, in which each pixel is individually addressed. "It is a necessary step when considering video or computer applications," says Thierry Robin, general director of Thomson-LCD. Indeed, the drawback of passive matrix screens (controled by lines and columns) is that they reproduce hues poorly and, most important, have too long a response time.

Today, the challenge for the French is industrial implementation. "To produce flat screens at acceptable cost, we must make up a two-year lag behind the Japanese," confides Jacques Guichard, in charge of CNET's Visage videophone program. There is no lack of problems to be solved. To begin with, large-enough screens must be produced. Due to a lack of equipment adapted for the purpose, the manufacture of screens more than 18 inches high can scarcely be considered for three years. This is because treating large surfaces of thin glass is still tricky (Sharp, which announced the development of a 14-inch model in its laboratories two years ago, has still not brought it to market). That is one of the reasons for the program launched by Japan's MITI, which aims to develop a screen one meter across diagonally that would allow the development of the necessary machines, processes, and materials.

The other obstacle is output and its economic limitations. The bigger the screen, the poorer the output: In microelectronics, the defects on a silicon wafer containing several chips lessen output proportionately. But a single flaw during deposit of the pixel matrix on the screen means zero yield! Overcoming this constraint would require clean rooms well above the class 100s, even class 10s, used to manufacture integrated circuits. "New approachs could be the solution to mastering production of large screens," explains Thierry Robin.

This obsession with output prompted the CNET to develop an original technology (Fr70 million were invested) industrialized by Sagem in the Planecran consortium since 1988. "This technology uses only two masking levels, instead of the five or six steps commonly used by other manufacturers," explains Polen Lloret, director of diversification and development at Sagem. Even though the transistors controling the liquid crystals deposited on the surface of the screen are a bit less

conductive, the process has the advantage of being rapid. Planecran has just announced an initial 4.5-inch model. To overcome economic constraints and "stick" to the realities of the television market, which will require screens much larger than the 14-inch ones now feasible, the Japanese have already invested some Fr5 billion in under 10 years. Sharp, Toshiba, Hosiden, Seiko, Epson, and Hitachi have taken the lead: Sanyo, Mitsubishi, Sony, Mitsushita, and even NEC are in the race. The first group has high efinition television in mind; the second is thinking of portable computer systems.

This surge has prompted French government authorities and manufacturers to gamble on a large-scale technological program. The advantage of this strategy is that it offers duration and job opportunities that are staggered over time, as technological progress is made: first the videophone and avionics applications, then high definition television.

Accordingly, Thomson-LCD (a staff of 70), which has invested Fr100 million in liquid-crystal screens, has announced it will produce the first 9-inch flat screens for aeronautic use in its Voreppe-Moirans factory (Isere). In television, the company is focusing on developing liquid-crystal matrices to replace cathode tubes for the projection of television pictures. This route neatly sidesteps the obstacle of producing large screens (an LCD lens 3 inches in diameter suffices). Gains still need to be made in integration. High definition television will require etching figures smaller than 50 microns, compared to the 200 or 250 microns mastered thus far. But the solutions do not differ from those of microelectronics.

As for SAGEM, it embarked on the adventure with the idea of finding applications in telecommunications, data processing, and automobiles. Those outlets would allow it to envisage a quick buildup of its pilot production line, on which 35 people are already employed.

French manufacturers are now aware that only knowledge of production line problems will enable them to progress in the technology.

Thomson-LCD's Flat Panel Display Mass Production Evaluated

91WS0166A Paris INDUSTRIES ET TECHNIQUES in French 21 Dec 90 p 10

[Article by Laurence Girard: "Flat Screen Mass Production: When?"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Thomson-LCD knows how to make screens for avionics. Will it know how to mass produce them?

"Dual strategy" is the term Thomson uses to justify its industrial venture into flat screens. It means starting with very-top-of-the-line liquid crystal display [LCD] applications for the cockpits of civil and military planes, and progressing to applications for the general consumer products market in five years. What are to be the stages of this journey from the military to general consumer products? A mystery. Or at least, in part. For, Thomson has lifted a corner of the veil over what it considers to be an intermediate stage: Rear-projection. Be that as it may, nothing about this venture is obvious.

Since September, screens measuring 9 inches on the diagonal, for avionics, have been emerging in driblets from Thomson-LCD's clean rooms at Grenoble. While the actual manufacturing time for a hard screen is 10 hours, the overall turn-around time of the process is in fact approximately 1 month. Aside from the low productivity inherent in the chosen technology (TFT [Thin Film Transistor]), the current process is limited to screens measuring approximately 15 inches on the diagonal. As for cost, it is best not mentioned. Understandably, Thomson is presently limiting its activities to very-top-of-the-line applications.

Use of rear-projection flat screens is the next stage, as Thomson sees it. Lacking the know-how to manufacture large-area (30-in) flat panels, the use of LCDs provides a solution to the problem of large-format image displays. It consists of integrating several small-sized (2 in x 3 in) monochrome flat screens into an apparatus similar in philosophy to a slide projector. Thomson plans to unveil a prototype of such a rear-projection system in 1991, and to market it a year later. It remains to be seen whether this system will progress beyond the stage of institutional and professional markets and succeed in convincing the general public. In any case, Thomson intends to make it one of the vehicles for the introduction of HDTV [high definition television] in 1995.

But Thomson's entry into the budding mass markets for flat panel displays—microcomputers, automobiles, and telecommunications terminals—appears more problematic. "The question is now before us," says Erich Spitz, the group's scientific director. "We do not know yet which of the markets will be truly self-sustaining. The automotive market is a difficult one, in which prices are a serious problem. And we must consider our industrial background. We want very much to be a major player in the HDTV sector, but not specifically in that of flat panel displays." There should be no mistaking the fact that the mass production of flat panel displays is not likely to be ventured into in the absence of a team-up with partners, if for no other reason, because of the huge investment called for. It is estimated to be on the scale of billions of francs.

France: CNET Modifies Functions in Microchips

91AN0257 Paris FRENCH TECHNOLOGY SURVEY in English Dec 90-Jan 91 p 11

[Text] A team in the Physics and Technological Research Group at the National Telecommunications Research Centre (CNET) in Grenoble has developed a new technique for modifying a function inside a completed microchip. The modification is done by directly writing in new connections using the so-called "laser microchemistry" method.

The principle of the method is to induce a chemical reaction in the form of deposition or local etching on the surface of the circuit to be modified, in the focussed beam of a power laser. With an ionized argon laser emitting in the visible or near ultraviolet, dimensions of the order of a micrometer can be achieved at the focus. The resulting rise in temperature is highly localised and also of sufficiently short duration for no damage to be caused to the underlying components in the circuit. Of course it has been possible in the past in this way to cut connections in order to isolate part of a circuit during testing, simply by suitably adjusting the laser power.

The circuit is placed in an enclosure filled with a suitable gas, and photothermal or photochemical (according to the conditions) breakdown of molecules at the focal point of the laser results either in a deposit on the surface of the circuit or etching occurring in the surface layer. By moving the focal point on the surface of the circuit, with controlled speed and positioning, a new connection or contact can be written directly.

The capability of this technique has been demonstrated in numerous tests, which have confirmed the economic savings it introduces in the production of new integrated circuits. Its fields of application are enormous, notably the development of integrated circuits, the customization of existing networks, the reconfiguration of complex circuits involving redundancy, and finally the correction of local manufacturing defects. With appropriate gases the same machine can treat components fabricated by means of any manufacturing technology: Si, III-V, II-VI, flat screens, etc.

France: Philips L-Neuro Chip Described

91AN0242 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 24 Jan 91 pp 14-15

[Article by Claire Remy: "Neural Signal Processors: 'The Path is Clear'"]

[Excerpts] The Philips Electronics Laboratories (LEP) and Telmat have designed a neural computer around specialized chips. This is the first step toward industrialization in Europe.

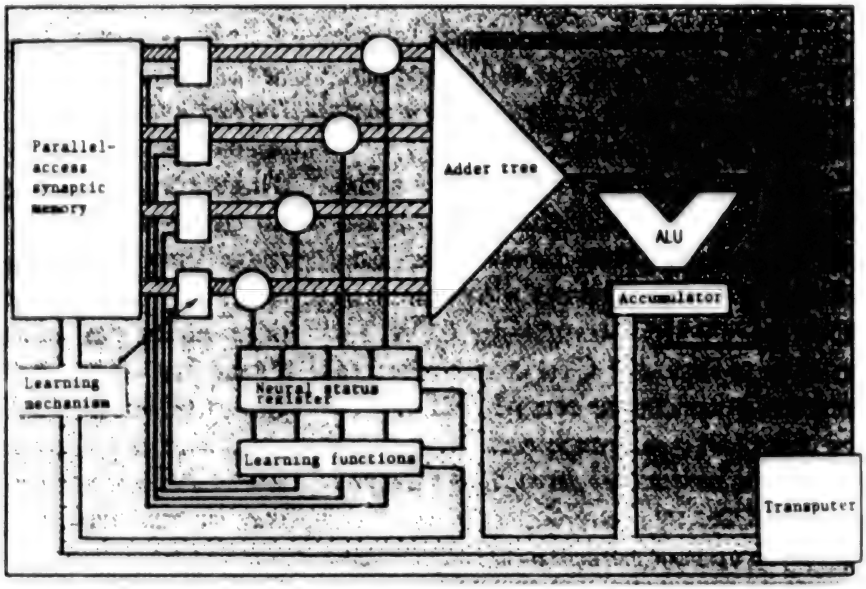
Researchers at LEP have presented their very large-scale integration neural circuit (VLSI), the L-Neuro, thus paving the way for neural signal processors. The main advantage of this specific circuit in relation to neuromimetic software is a shorter learning and problem solving time, which is reduced by a factor of 100 or more.

LEP has been working for several years in the field of neural networks, in particular on their integration into hardware, with its activities ranging from the design of dedicated VLSI circuits to the design of specialized machines based on these chips. This circuit, known as L-Neuro, meaning Learning Neuro Chip, represents the hardware implementation of neuromimetic models experimented on software. Each L-Neuro simulates the operation of 64 neurons. Developed in 1.5-micron complementary metal-oxide semiconductor (CMOS) technology by VLSI Technologies in the United States, the chip integrates a random access memory (RAM) storing 1,024 connections between neurons (for 16 input and 64 output neurons) and 16 processors operating in parallel to determine the status of the 64 neurons and their interconnections. These neurons can be arranged in two layers of 32 neurons or in one layer of 256 neurons (input layer) and one of 4 neurons (output layer). Each neuron has 1 to 8 bits and the synaptic coefficients are coded on 8 or 16 bits.

Microprogrammable Learning Procedure

The L-Neuro is original in that it integrates a microprogrammable learning procedure. This has been made possible thanks to a considerable reduction in the time required to adjust the neural connections during the learning phase. The performance of the circuit was shown during an image compression demonstration at a conference held in London in February 1990. Here, a neural algorithm was used to track the relevant information in an image to enable its compression without losing information. This algorithm implies that the relevant information of these images has to be learned, a learning process which L-Neuro can handle in real time. When developing neural machines using these circuits, it is essential to adopt a flexible architecture allowing the implementation of a wide range of algorithms and neural network structures. It is indeed often necessary to use different approaches for a given application, such as image processing. The construction of algorithms is thus the neural equivalent of binary decision trees. To ensure this flexibility, L-Neuro has been designed for use in a computer. Not just any computer, because we are talking here of Telmat's T-Node, a system based on Inmos' Transputer technology. These processors operating in parallel work well with such circuits: They are rapid enough to process part of the communications protocol needed when several neural chips are being used. Each of the T800 transputers is connected to four L-Neuro circuits that it controls, thus constituting a 256-neuron neural network (4x64), Christian Pflieger from Telmat explains.

The transputer controls the loading data. Several transputers can be made to communicate to achieve more complex networks. Telmat has announced that the machine will be manufactured in 1991. Several industry-related applications are being considered: compression of TV images, signal recognition. The advantage of this system over software simulations on transputer networks is particularly perceptible in the learning phase, which is reduced by a factor between 20 and 100, i.e., to a few days instead of one year (the average time needed to develop relatively simple applications using software-based methods). In addition, Telmat is continuing work on a new generation of neural computers which will contain more neurons and operate at higher speeds. Another L-Neuro application is the incorporation of



LEP's VLSI L-Neuro neural circuit. The T800 Transputer, shared by four L-Neuro chips, controls learning and ensures the network's flexibility. This circuit is used as basic building block.

these chips in ordinary PCs to build "digineural" signal processors. [passage omitted]

In Europe, the ESPRIT II Pygmalion project aims to promote neural network applications in European industry. In addition to software development, it also seeks to integrate neural networks on silicon using wafer-scale integration technology, through which more neurons can be integrated on a single chip. Demonstrations of VLSI networks containing several neurons have already shown high performance rates. In France, different projects are being conducted at universities (Orsay, Grenoble, and others). The National Polytechnic Institute of Grenoble (INPG) is developing a neural processor on silicon in 1.5-micron CMOS technology. [passage omitted]

Role of Dutch Universities in JESSI Analyzed

91AN0248 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 24 Jan 91 p 3

[Article: "Experts Argue For European University Chip Research"]

[Text] Facilities in the three technical universities responsible for semiconductor manufacture must be merged into a European collaborative structure. This is one of the recommendations made by a three-man commission of British experts in an advisory report to Minister J. Ritzen of Education and Science and Minister J.E. Andriessen of Economic Affairs.

The two ministers set up the commission in October last year as a result of the "Philips affair." The electronics concern had decided at the start of September 1990 to halt a large part of its activities in the field of submicron technology. Nevertheless, Philips still continues, albeit to a lesser extent, to take part in the Joint European Submicron Silicon Initiative (JESSI). The two other major partners in this EUREKA project are Siemens from Germany and the French-Italian concern SGS-Thomson.

A considerable number of Dutch universities and research institutes are involved in JESSI subprojects, in particular the technical universities of Delft, Eindhoven, and Twente; the University of Amsterdam; and the State University of Utrecht. Participating research institutes are the Technical Physics Department (TPD) and the Physics and Electronics Laboratory (FEL) of the Netherlands Organization for Applied Scientific Research (TNO) together with the Prince Maurits Laboratory

In addition to examining the consequences [of Philips' withdrawal] for universities and research institutes, the three British experts (B. Oakley, I. Mackintosh, and R. Morland) also investigated whether Dutch university participation in JESSI should receive extra financial support. Their third study subject concerned the management policy needed for the facilities at the three technical universities. In particular, this concerned microelectronics research and the design and manufacture of chips. The three experts feel that the quality of research at the three technical universities is in general good, particularly in the areas of components physics, design technologies, architectures, micromechanics, and sensors. Research into analog circuits is also important for industry. Weak points are in process technology and the development of auxiliary tools, which do not result in an adequate number of industrial applications

According to Oakley, Mackintosh, and Morland, however, it is still necessary to bring the activities in Delft, Twente, and Eindhoven together into some sort of European structure, in order to optimize sharing of the very high costs involved. The commission of "wise men" suggested that a natural fusion partner for the Dutch institutes would be the Interuniversity Microelectronics Center (IMEC) in Leuven, Belgium. The experts also suggest that Dutch researchers should actively participate in Eurochip, a part of the European Strategic Program for Research and Development in Information Technology (ESPRIT) for the manufacture of a small series of chips for technical scientific education and research.

Feasibility

The British experts consider JESSI to be essential for the survival of the European chip industry, although they have serious criticisms on the selection process of project proposals for basic and long-term research. The financing of this part of JESSI belongs in the long run, they say, to the EC ESPRIT program.

Because it is possible to maintain a viable semiconductor industry within Europe, the researchers were not highly alarmed by the effects of Philips' withdrawal on Dutch universities and research institutes. High-quality chip research is vitally important for Europe to maintain and eventually improve its position in the world market. Finally, the three Britons recommended a more efficient funding scheme for Dutch microelectronics. At the moment the formulation and assessment of proposals are not sufficiently separate from each other.

According to a spokeswoman for the Ministry of Education and Science, Ministers Andriessen and Ritzen are now preparing the government's position on the matter, which must be ready before 25 February.

Philips Reallocates JESSI Participation

91AN0254 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 31 Jan 91 p 9

[Text] When it pulled out of the memory project of the Joint European Submicron Silicon Initiative (JESSI), the Dutch company Philips announced that it would continue its participation in other projects.

Today, more details are known. Dr. R.P. Kramer, technology director at Philips and president of the steering committee of JESSI's "Technology" subprogram, announced that part of the resources made available by the withdrawal from the static random-access memory (SRAM) project—both finances and manpower—will be reallocated to the Joint Logic project, which is coordinated by Philips.

Research and development work being carried out by the Dutch group in this project will be concentrated in Nijmegen. The project, which brings together European Silicon Structures (ES2), MIETEC, SGS-Thomson, Telefunken Electronic, Matra-MHS, Siemens, STC, and Plessey, involves the development of a production technology for structures of 1 micron, then 0.7 micron and, finally, 0.5 micron over a 7-year period. The 0.7-micron technology is scheduled to be ready for qualification by the end of 1991.

The basic process is partly the result of research carried out under the Megaproject and the European Strategic Program for Research and Development in Information Technologies (ESPRIT). In order to allow European semiconductor manufacturers to become competitive in all sectors of digital integrated circuits, this basic process will be upgraded with options for specific applications such as, for example, an analog process, a nonvolatile memory technology, or a multilevel metallization technology.

The project, which was launched last June, has obtained funding for the initial 18 months. As from 1992, it will be necessary to renegotiate new subsidies for the continuation of or possible extensions to the project. All this takes time, too much time, but Philips, which has internally already dedicated new resources to the development of logic circuits, is ready to invest even more in this project," says Dr. Kramer.

Dutch Public Research Representative Quits JESSI Board

91AN0262 Amsterdam COMPUTABLE in Dutch 8 Feb 91 p 2

[Article by Yvonne Ton: "STW Withdraws From JESSI Board"]

[Text] The Hague—Prof Dr. P. Balk, representative of the [Dutch] Foundation for Technical Sciences (STW), is to withdraw from the executive board of the Joint European Submicron Silicon Initiative (JESSI). The STW feels its position on the executive board has become untenable, because of the Dutch Government's failure to provide the necessary funding for research conducted within the framework of JESSI.

Within this board, the STW represents the public research institutes of the European countries which are involved in JESSI, such as the Interuniversity Microelectronics Center (IMEC) in Belgium and the Laboratory for Electronics and Information Technologies (LETI) in France. Along with STW as only nonindustrial partner, representatives from several companies—including Philips and Siemens—are also on JESSI's executive board. STW was one of the initiators of JESSI, together with the Foundation for Fundamental Materials Research (FOM).

STW Director Dr. C. le Pair fears that the prestige of Dutch scientific chip research in Europe is being impaired by the failure of the Ministry of Education and Science (E&S) as well as the Ministry of Economic Affairs (EA) to make a decision about the subsidy

request, which was submitted more than a year ago. The 96-million-guilder subsidy request concerns JESSI's Basic and Long-Term Research (BLR) subprogram.

A spokeswoman for E&S admits that the procedure keeps lingering on, but says that this is due to Philips' decision to withdraw from the static memory chip research segment. This decision prompted E&S to request the advice of three British researchers on the future of microelectronics in the Netherlands. Now that all the reactions to the report, which was published in mid-January, have been received, the subsidy request will be discussed during a debate to be held on 20 February.

However, le Pair has very little understanding for the reasons produced by E&S for the delay. "Even if I knew at this very moment that the subsidies would be approved next month, it would not change the fact that our prestige has already been discredited." Many researchers from Dutch universities are involved in projects which fit within JESSI's BLR subprogram. According to the STW, participants from other countries in these subprojects are becoming impatient and are wondering whether the Dutch researchers will be able to cope with the jobs they have been entrusted with. STW and FOM are also members of JESSI's BLR submanagement board. Whether or not STW will also withdraw from that board depends on the government's decision concerning support for BLR. If this decision is negative or put back to a later date, the STW considers the time and efforts spent by university professors to run JESSI no longer justifiable.

Germany: BMFT Funds R&D on Chip Manufacturing Techniques

91MI0219 Duesseldorf HANDELSBLATT in German 21 Feb 91 p 19

[Text] The Federal Minister of Research and Technology has recently approved 1 million German marks for a project on material surface modification with ion beams. A group led by Heidelberg radiation chemist Prof. Berhard K. Wolf will focus primarily on developing processes for producing better electronic components and conductors. The Daimler Benz research institute in Frankfurt/Main and the University of Muenster Physics Institute are also taking part in the project.

This research work arises out of Germany's desire to improve its disastrous position in chip production and other advanced technologies as compared with Japan and the United States. In 1989, European semiconductor firms' share of the chip market—integrated circuits for digital electronics—fell by 1.8 percent to 36.7 percent. The Europeans thus have a share of little more than one third of their own home market. They contribute a meager 7.4 percent to world integrated circuit production.

As chips get smaller and smaller, more and more switching elements are accommodated on a minute surface. This involves two problems: More heat is generated and the connecting wires between the switching elements must also be miniaturized. The plastics currently used as substrates do not withstand temperatures of over 200°C. If the conductors are bundled together into three-dimensional stacks, as is planned, to give even smaller structures, current heat exhaust methods will no longer be sufficient.

New heat-resistant base materials for chip assembly constitute one solution. Ceramics are one possibility, polyimide (better known under its trade name of Kapton) another. But inadequate bonding of the conducting metal compounds to the substrate has so far stood in the way of a breakthrough. The project headed by Heidelberg radiation chemist Berhard K. Wolf is trying to mesh the materials together with an ion beam process. The beam does everything that the do-it-yourself wallpaper hanger could wish for: It roughens the substrate up and acts as an 'adhesive' between the two layers by triggering a chemical reaction.

A second aspect comes into play where increasingly miniaturized structures are concerned. In the ion beam, the radiation chemist has a high-precision instrument with which he can operate in minimal space, just as in microsurgery. The widths of conductive connections between microchips currently range from 10 to 100 micrometers, so, laid out side by side, they take up a relatively large amount of space. Wolf wants to reduce their width to one micrometer or less, which means less than one thousandth of a millimeter. Two processes are currently being tested. The first, an etching process, bombards the two-dimensionally premetallized basic material with ions along narrow strips, thus increasing the bond strength of the areas exposed by meshing the atoms. Then it is only a small step to etch away all the remaining metal.

Metal-Ion Beams Implant Nuclei in the Plastic

The second method takes the direct route. Metal-ion beams implant nuclei, for example, copper nuclei, in the material as small atomic islands that can be extended by galvanic or electrochemical precipitation until they form an extremely narrow conductor. In another variant, a gaseous chemical compound is made to flow over the materials. Wherever it encounters the ion beam, the compound decomposes and the metal precipitates onto these areas.

Wolf's laboratory used to specialize only in rust and wear protection. When radiation chemists bombarded the top edge of a hand-sized cylinder with ions, the tool subsequently stamped twice as many soft drinks cans out of the basic metal as before: 400,000 as against the previous 200,000. When they stretch a hard-chrome plated piston ring in their equipment, the wear and tear at points subjected to particular stress is drastically reduced after ion bombardment. The result is that working life increases and small, fast-running diesel motors require less frequent repairs.

Wolf's research is of interest to the aerospace industry as regards lengthening the useful life of aircraft, to the extent that it depends on rust, or protecting the planned European spacecraft Hermes from damage caused by extremely high temperatures on reentry into the Earth's atmosphere. The question of which materials rust or separate out, and how quickly, is still decisive, and maybe even vital, for ultimate nuclear fuel storage. The scope of the group's work extends well into medical engineering, in areas where the durability of dental appliances and knee and hip joints is important. The research is even relevant for scratch-resistant spectacle lenses.

Before the field of microelectronics was opened up, the basic question was limited to the aforementioned major problems: surface modification by ion bombardment for rust and wear protection. The conventional method of protecting metal against rust and wear relies on a thick layer of paint or a well-fitting metal piece that can subsequently be galvanized or tin-plated. The other option is to process the metal into a rust-resistant alloy, like stainless steel. This example brings up a problem that torments industry and the Heidelberg radiation chemist alike: Mixing cheap iron with expensive chromium or nickel throughout is a process that Wolf describes as "pure waste," as only the surface of a tool or component is attacked and needs protection against rusting. The ion beam process renders only the surface rust- and wearproof. In many cases it also saves environmental pollution as the galvanic methods used to date often cause heavy pollution.

Unalloyed steel rusts as soon as it comes into contact with damp air. If rust-resistant aluminum is vapor deposited onto it, new problems arise, as the aluminum layer does not bond well with the ferrous substrate. This changes under ion bombardment, which works like sandblasting. "The ions almost stir the atoms around," says Wolf. They stir them into the solid substance to a depth of about one ten-thousandth of a millimeter. This creates a solid bond between substrate and coating. The scientists generally use an inert gas, which does not react chemically itself, or bombard the iron directly with aluminum ions that thus become closely meshed at the atomic level and are incorporated into the surface.

Wear protection is less a matter of bonding and pores than hardness: The part under stress must not wear away, no matter how great the force and heat to which it is subjected. Metal-nitrogen or metal-carbon compounds such as titanium nitrite or titanium carbide have proved particularly suitable. In these processes, Wolf vapor deposits titanium onto a surface, bombarding it with a nitrogen ion beam at the same time. This ensures that equal amounts of titanium atoms and nitrogen ions are combined and, therefore, that the new surface will subsequently be composed half of one material and half of the other.

The major aim of the radiation chemist and his group is to customize every surface according to requirements. The route to this destination has been chosen, but there is still a long way to go.

Germany: New Simulator Linkup Makes for Quicker Chip Design

91P60139 Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 26 Mar 91 p 8

[Text] At the University of Frankfurt, initial successes have been achieved with a new type of simulator interconnection system. The system is to be applied in the industrial design of integrated circuits and in robotics. It is expected that a considerable reduction in the development time [required] for hightech products can be achieved using this system. The starting point for the scientists from Frankfurt was a problem in the manufacture of highly complex circuits for electronic systems. For reasons of cost and time, these circuits first require a computer simulation of product characteristics. This is accomplished using computer simulation programs.

Of course, nowadays, there are several [such] programs. The greatest demands are levied upon simulation technology, since, apart from the chip design proper, the integration of mechanical components must also be included. Thus, the simulation of individual components is not sufficient. What is required is a simulator linkup tieing together individual [simulation] approaches. This linkup is best effected through the use of an open simulation system into which any simulation program at all can be integrated.

The project, headed by Prof. Dr. Klaus Waldschmidt of the Institute for Technical Computer Science, is being conducted within the framework of the combined research of the Federal Ministry of Research. Apart from Cadlab in Paderborn and the University of Frankfurt, others participating as partners include: Siemens AG, Telefunken, Bosch, Dosis GmbH and the University of Dortmund. Waldschmidt and Dr. Michael Bechthold developed a significant portion of this system. Apart from the fact that it is open to different simulators, the Frankfurt approach also makes available a unified user interface for all programs.

The software is broken down into modules so that the simulation can be enhanced by means of parallel processing. The scientists point out that the system will also expand the market for special-purpose simulators. At present, Bosch's Bonsim (analog simulation) simulator, Siemens' Cosi (timed systems simulator), Dosis' Dacapo III (system simulation), Telefunken's Disim (gate simulation) and the University of Frankfurt's Hadis (analog-digital simulation) are integrated into the system. Other [simulation systems] should follow.

In the initial operational step, the hardware system to be built and tested is partitioned into modules. That is done using the VHDL/S language or a graphics editor. The

modules are subsequently described in the language of the simulation program selected, with the aid of a standardized interface. Prior to the actual simulation, there is an internal test of the model description and its connections. The required matchup among the circuit modules is carried out automatically. Subsequently, simulation is carried out using the experimenter function. The user can take active part in the simulation. The results from all the simulators are subsequently displayed as combined results.

SUPERCONDUCTIVITY

Germany: Mining Application for Superconductivity Described

91WS0152A Duesseldorf WIRTSCHAFTSWOCHE in German 18 Jan 91 pp 52-56

[Article by Wolfgang Kempkens: "Superconductivity: Sensitive Technology in a Rough Environment; Power From the Cold"]

[Text] Karl-Heinz Unkelbach does not worry about his machine, although it is equipped with extremely sensitive technology and operates far from civilization in an open-pit mine in Turkey. "It can be run with boxing gloves," cracks the project manager of KHD [Kloeckner-Humboldt-Deutz] Humboldt Wedag AG in Cologne. Descos is the name of the machine built for the rough life with a hightech core. By means of a superconducting magnet it separates the valuable material magnesite from unusable rock.

Superconductivity, the zero-loss power transport across any length of distance, has not been an exclusive technology for a long time now. Previous application areas, laboratories and major installations, as well as diagnostic clinics, largely have one feature in common; however: They are clean, sometimes even extraordinarily clean, and not at all comparable to a mine. And treatment with boxing gloves would hardly be something the equipment used there would tolerate.

The people from Cologne built the first unit using the technology of superconductivity that has survived in the rough industrial environment, 5,000 to 6,000 hours of constant operation without any kind of servicing. The machine is run by Turkish electricians. It sits in a sort of shed on the land of the Magnesit Anonim Sirketi mining corporation in Tutluca, a village of 100 souls. At the mine that is shaped like a terrace, 230 kilometers east of Istanbul and 250 kilometers west of Ankara, magnesite is mined by blasting. Gigantic front loaders shovel the mixture of valuable material and ferruginous waste onto moving bands which bring it to the separation plant. The impressive quantity of 100 tonnes an hour is processed.

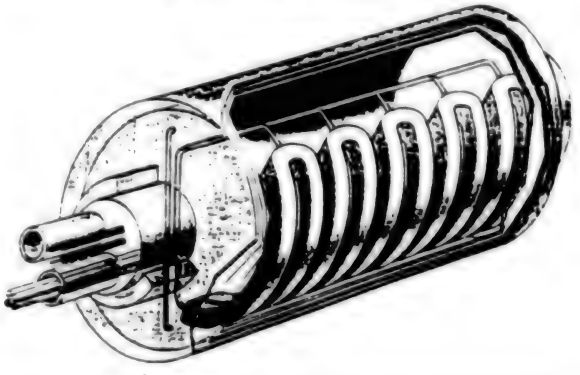
The minerals are broken up in a crusher, transported by hoist to the Descos and poured out onto its thick, turning roller. The powerful magnetic field from the interior of the cylinder casts its spell over the waste materials. Since it contains iron, the waste material sticks for a while to the roller, while the—despite its name nonmagnetic—magnesite is hurled out in a wide arc: The streams of material have been separated.

Magnetic separation in ore mining is nothing new. This type of facility has been used for decades. KHD alone has sold far in excess of 100 of these 1-tonne-heavy monsters, all of which were equipped with conventional permanent or electromagnets. More than 2 teslas—that is a measure of the power of the magnetic field—cannot be reached even for small facilities, since the need for power for even greater field intensities rises to the astronomical. Even this already admirable achievement—50,000 times the earth's magnetic field—is not enough to separate extremely weakly magnetic waste from nonmagnetic valuable materials.

With the superconductivity concept the KHD team elegantly overcame the power consumption and output hurdle. They had boldly aimed for 4.5 teslas. Only 3 were reached, but that is sufficient for magnesite separation.

The coil that did not measure up was built by Siemens AG. Approximately one tonne of the hair-thin wire made of the superconductive alloy niobium-titanium, embedded in copper, was developed into a system, and placed in the inside of the roller. But even after months of efforts it was not possible to feed the required current, calculated at 750 amperes, into the system. The system became exhausted at 500 amperes. Hoping for a better result, KHD has given the contract for the next coil, which is finally to reach the intended power, to Asea Brown Boveri AG (ABB) in Mannheim.

Superconducting Coil in a Helium Tank: Maintenance-free in a rough environment



The coil of the magnetic separator is in a tank of nonmagnetic special steel, in which liquid helium with a temperature of minus 269 degrees Celsius is constantly being pumped. The liquefaction plant, delivered by the Swiss company Gebrueder Sulzer AG, is located outside the shed in a container. In an alternating cycle of compression and decompression, the initially volatile inert gas is gradually cooled until it reaches the liquid state. The energy supply operates from another container.

The magnesite-rock mixture rumbles on the turning roller, in which the helium tank with the powerful coil is hidden. The drum was manufactured with the precision of fractions of a millimeter in Ottobrunn near Munich by Messerschmitt-Boelkow-Blohm GmbH (MBB) from fiber-reinforced synthetic material.

Magnesite is a desirable raw material for the manufacture of fire-resistant brick, such as is needed for lining blast furnaces and power plant boilers. The mineral does not melt until it reaches a temperature of 3,000 degrees Celsius. But it is only sufficiently durable if it contains no traces of iron, which would corrode in the aggressive atmosphere of a blast furnace and seriously reduce the lifetime of the fire-resistant lining. The Turks separate approximately 400,000 tonnes of this mineral from nearly 600,000 tonnes of rock annually in a three-shift, seven-day a week operation. Per tonne of raw iron, according to a general rule, one kilogram of magnesite is used up in the form of wear on the blast furnace lining.

Codeveloper Horst Cordes gets lyrical when he thinks of the future: "Superconductivity opens up totally new possibilities for separation, above all for economizing with resources." But before, as he puts it, "the interest had been pried loose," there was a long phase of distrust. "Some potential customers feared that the rocks would freeze together, when they heard of the sub-Arctic temperatures," Cordes muses. But now scores of seriously interested parties are announcing themselves.

One of them operates a mine in Phalaborwa at the edge of the South African Krueger National Park. Nearly 80 percent of the material mined is waste. The traces of iron hidden in it are so small that not even the magnetic force of the first Descos machine would have been sufficient to separate them. The 4.5 teslas anticipated from the new ABB coil are needed for this task. This puts the South Africans into the group of mining companies which is being offered the second superconducting KHD magnetic separator. It would replace waste water-containing flotation, with which phosphorus compounds are still separated from wastes.

Roland Pfeiffer, head of research and development as well as new technologies at KHD, outlines yet another series of applications. "One could even desulfurize coal before burning it," he says. To be sure, the supermagnet would only eliminate the part that has combined with iron, which generally is about half. This would still not make gas purification equipment superfluous, but it could be made smaller and thus less expensive. Furthermore, operating costs would drop.

The KHD management has only recently opened talks with RWE [Rheinisch-Westfaelisches Elektrizitaetswerk] subsidiary Pro Mineral Gesellschaft zur Verwendung von Mineralstoffen mbH in Essen. Its task is to find application possibilities for the gypsum that is produced in the desulfurization facilities of lignite-based power plants. Since, unlike gypsum from hard coal-based power plants or in the natural state, it is not white but a muddy brown, it is difficult to find customers for it. Superconducting magnetic separators could pick out ash and clay residue, which is usually coupled with particles of iron, and help the product become pure white, the way the customers want it.

KHD project manager Hans-Dieter Wasmuth also brings up the processing of quartz sand as a future prospect. Manufacturers of semiconductor silicon for high-performance chips are now no longer satisfied with purities of 99 percent. They are trying to get increasingly closer to the 100-percent mark. The ice-cold KHD technology, according to Wasmuth, could accelerate this approximation process by eliminating all foreign molecules in which there are magnetizable atoms.

And the magnetic separator even opens up new perspectives in environmental protection. Pollution in waste water settles with ferric salt particles. Some noxious substances even combine with them, for example phosphates. Until now some of the salts have been flushed out of the purification plant and pollute the subsequent waters. Descos could suck them out almost completely.

The only thing that dampens these rose-colored future prospects somewhat is the cost of the units. "The buyers have to count on 5 to 6 million marks," Unkelbach points out. On the other hand: Constantly growing demands for material purity and a continuous increase in costs for environmental burdens will keep reducing the importance of the investment costs.

Boxed material: 11th Innovation Prize of the German Economy: The Winners

Out of 119 entries, the jury chose as winner of the 1990 innovation prize: the superconducting magnetic separator by KHD Humboldt Wedag AG in Cologne. The device, which weighs a tonne, separates ferruginous waste from the valuable material magnesite in a Turkish surface mine. The people in Cologne made a breakthrough with the Descos facility. They transferred the highly sensitive superconducting technique to the rough everyday life of industry.

The special prize, endowed with 10,000 marks, of the Deutsche Beteiligungsgesellschaft in Frankfurt was given to Duerr GmbH in Stuttgart (see p 60 [not included]). It offers an inexpensive technique for eliminating small amounts of solvents in large amounts of air, a problem which every paint shop faces.

For the first time, applicants from the new Laender were also considered. Here, the Kurt Schwabe Research Institute of Meinsberg in Saxony was the winner. A five-man team developed the so-called Isfet measurement system based on field effect transistors (see p 56 [not included]). The first sensors ready for the market determine the acidity of liquids. The honors will be given out tomorrow, Saturday, at a grand ball in the Old Opera in Frankfurt. Applications for the Innovation Prize of the German Economy, which is sponsored by the federal minister for research and technology, are now being

invited for the 12th time by the Rhein-Main Economic Club, WIRTSCHAFTSWOCHE and the Munich technology magazine HIGH TECH. Application forms may be had from the Rhein-Main Economic Club, Schillerstrasse 18-20, 6000 Frankfurt 1, and from WIRTSCHAFTSWOCHE, Kasernenstrasse 67, 4000 Duesseldorf 1.

TELECOMMUNICATIONS R&D

EC on Satellite, Mobile Communications

91AN0246 Amsterdam COMPUTERWORLD in Dutch 23 Jan 91 p 21

[Interview with Pieter S. Weltevreden, EC Commission DG XIII director, by Paul Ruell: "ONP [Open Network Provision] Must Guarantee Fair Competition; European Commission Works on Measures and Directives"; first three paragraphs are COMPUTERWORLD introduction]

[Text] The European Commission has recently published a Green Paper on Satellite Communications. A similar publication covering mobile communications is in preparation.

The Commission appears to be making good progress, but friction among its various directorates is still leading to delays and a lot of red tape.

Here is an interview with Pieter S. Weltevreden, director for telecommunications policy and head of DG XIII, the European Commission's directorate-general responsible for telecommunications and information.

COMPUTERWORLD: Not long ago the Green Paper on Satellite Communications was published. Have reactions been positive?

Weltevreden: Yes, reactions were in general positive, but several interesting comments were also received. The Green Paper argues in favor of more liberalization, but various institutions such as Inmarsat, Eutelsat, and Telsat are arguing for greater caution and a restriction in the number of license holders. An inquiry is under way and all interested parties will be able to present their case. We, as the European Commission, are endeavoring to reconcile these positions.

COMPUTERWORLD: What is ONP and within which framework does it fit?

Weltevreden: ONP stands for Open Network Provision. It consists of measures and directives which must ensure fair competition. The European Commission states simply that "there must be at least one license holder." Most countries have adopted this directive, and only the United Kingdom has more than one license holder. In addition, the license holders (the PTTs) are permitted not only to act as network operators, but also as suppliers of services on the network in direct competition with private services suppliers. You can understand that this creates a potentially difficult situation. Indeed, there is a danger that the PTTs could abuse the fact that they operate the network on which their competitors also offer services.

That is why it is necessary to formulate conditions for accessing the network. This is what ONP is aiming for. It is quite clear: ONP contains all the conditions necessary for a liberalization of the sector.

COMPUTERWORLD: How far has the development of ONP progressed?

Weltevreden: General directives have already been laid down. Now it is a matter of filling in specific details, especially in the field of rental lines and integrated services digital networks (ISDN).

COMPUTERWORLD: Will the Commission also be involved in the setting of tariffs?

Weltevreden: Yes and no. We will not say what tariffs should be charged—because national disparities are allowed—but we do say on what basis the tariffs should be calculated.

COMPUTERWORLD: Meanwhile a new Green Paper on Mobile Communications is in preparation. When do you expect this to be ready?

Weltevreden: Sometime during 1991.

COMPUTERWORLD: This Green Paper will be important because of the large number of present and future telephone applications and technologies it will cover: cordless telephones, paging systems, Telepoint, the Digital Cordless European Telephone (DECT), the proposed GSM-standard for cellular mobile telephone systems. What do you intend to do?

Weltevreden: The important points for us are the pan-European dimension, together with digital technology. Our approach relies on these two principles. We have refused from the beginning to consider Telepoint because it does not conform to either of the two criteria. Perhaps Telepoint will find a gap in the market somewhere, but it is not a technology of the future. You might know that Telepoint is suffering; well, we are not unhappy with the situation. As far as DECT and GSM are concerned, both will be introduced officially during the course of this year.

COMPUTERWORLD: There has also been talk of PCN—personal communication networks....

Weltevreden: PCN belongs to the next generation of hardware. It could perhaps be useful to talk of it now, but it is still to a large extent a wonder of the future.

COMPUTERWORLD: Will credits be released for the development of ISDN terminals?

Weltevreden: No. DG XII will not make any development credits available, but do not forget that under the

European Strategic Program for Research and Development in Information Technology (ESPRIT) there is a great deal of attention being given to multifunctional terminals.

COMPUTERWORLD: When will there at last be a definite decision on terminal equipment?

Weltevreden: At the moment this directive is going through a second reading in European Parliament and I would imagine it will continue for at least another six months. Parliament has put forward a great number of amendments, of which some are acceptable. We are talking here of an important matter which is far from simple and has led to very detailed discussions. Manufacturers are following the affair closely and have put forward specific demands, for example in the field of test procedures. At the moment, each piece of equipment has to be approved by the various national testing centers. This does not accord to the wishes of the manufacturers, who are desperately pressing for uniformity, simplicity, and speed.

COMPUTERWORLD: Recently IBM decided to move its international telecommunications headquarters from the United States to London. A sign for the future?

Weltevreden: I do not think so. Perhaps IBM's decision should be seen less in the light of the European Community but rather in the light of a possible collaboration with British Telecom. I have heard rumors that IBM and BT are indeed contemplating cooperation, but that it is not yet completely clear what form this cooperation should take.

COMPUTERWORLD: It is often said that there is friction between the various EC Directorates. DG IV (competition) blames DG XIII (telecommunications) for a certain lack of speed and a tendency toward bureaucracy. Are there any difficulties between DG IV and DG XIII, or is there nothing the matter and is cooperation optimal?

Weltevreden: The answer is in each case negative. No, there is no friction, and no, cooperation is not optimal. I am in regular contact with my colleague from DG IV and these contacts are always excellent. There is no hint of friction or envy. Even so, exchanges between the directorates are not always speedy, simply because their respective points of view and basic assumptions are so different. Every comparison is difficult, but you should look at it like this: DG XIII is the architect of the future data communications infrastructure of the European Community, DG IV is the policeman. Each directorate's responsibilities are fundamentally different.

COMPUTERWORLD: The telephone infrastructure in the East European countries—to put it euphemistically—leaves something to be desired. Is anything being done to improve this?

Weltevreden: Well, the European Commission is obviously concerned about the situation in Eastern Europe, and not long ago launched the PHARE [Poland-Hungary: Assistance to Restructure Their Economies] program to the tune of millions of ECUs. Improvement of the telecommunications infrastructure forms a part of this, a part which falls under the jurisdiction of DG XIII. What we are doing can be summed up in five points: one, providing assistance with the establishment of good regulations; two, supporting the East European PTTs with modern management techniques; three, coordinating standardization efforts—shortly Poland and Hungary, among others, are to become members of the European Telecommunications Standards Institute (ETSI); four, organizing seminars; and finally, five, material support by delivery of equipment. We shall nevertheless not be too hasty in this and wish to be certain that the money is being well spent.

Siemens, NTT To Develop Fiber Optic Broadband Network

91MI0163 Duesseldorf HANDELSBLATT in German 14 Jan 91 p 16

[Text] In an international tender floated by the Japanese telecommunications company Nippon Telegraph and Telephone Corporation (NTT), in which all major telecom companies in the world participated, Siemens was the only European company selected to take part in NTT's VI + P (visual, intelligent, personal) program.

This program will develop and set up the infrastructure for the digital broadband network of the 21st century, which will provide all communications services from narrow- to broadband, including video communications.

The billion-German mark development is split into two projects, in both of which other leading companies on the international communications technology market will also participate. Fujitsu, Hitachi, NEC, the American subsidiary of Canada's Northern Telecom, Oki, and Toshiba will all contribute to the switching technology. The American giant AT&T, Fujitsu, Hitachi, Mitsubishi, and NEC will work with Siemens on the transmission technology.

Asynchronous glass fiber cables will be used for the new network. Siemens supplied the Bundespost with an initial switching system in asynchronous technology (ATM [asynchronous time multiplexing]) for its broadband ISDN [integrated services digital network] BERKOM project in Berlin back in 1989. Siemens is also participating in the development of the European broadband communications network IBCN (Integrated Broadband Communication Network) under RACE [Research on Advanced Communication in Europe]. Installation of the broadband glass fiber networks is due to begin in 1995 in both Europe and Japan. This is why NTT's VI + P project schedules prototypes of all switching and transmission systems for completion by mid-1992, and series products for delivery by 1995.

Thomson Launches HDTV-Compatible Set

91WS0187A Paris LE MONDE in French
13 Feb 91 pp 1, 24

[Article by Michel Colonna d'Istria: "Screens of the Future: Thomson Markets a High-Definition-Compatible Wide-Screen Television Set"]

[Text] Thomson markets a high-definition-compatible wide-screen television set.

On Monday, 11 February, the French government-owned Thomson group officially launched a new high-end rectangular-screen television set for the consumer market.

Despite its square shape, the Grand Arch of the Defense was probably the only possible choice for the official unveiling of Thomson's new television set, the first in its line of high-definition-compatible sets. Everything is grand about this new product: the screen, the stakes, the research costs, and the consumer price.

The Space System will be commercially available in France by early March, before summer in Germany and Italy, and later elsewhere in Europe. It is the first consumer television set in the world to adopt the new 16:9 wide-screen rectangular format (16:9 is the aspect ratio), which contrasts with the almost-square 4:3 format of current sets. This new format is what is used in the movies and, more importantly, what will be used for future high-definition broadcasts (1250-line HDTV [high definition television]), which this set will be able to pick up as soon as they become available, with the addition of the appropriate decoder.

The Space System already accepts all the existing broadcast standards: PAL [Phase Alternate Line], SECAM [Sequential Color and Memory], NTSC [National Television System Committee], and, with an optional decoder, D2-MAC [Definition 2 Multiplexed Analog Component]. The decoder plugs into one of the five Peritel sockets.

Its memory capability even allows it to reproduce these images with unparalleled sharpness by "doubling" the number of lines displayed. With a 93-centimeter diagonal screen, a system for reframing the picture to the desired shape, picture-in-picture capability, and five speakers to deliver the quality of stereo digital sound allowed by D2-MAC, the Space System offers a maximum of innovations. Its price (35,000 french francs [Fr]) is commensurate and limits it to an upscale market. In fact, the German Villingen plant will probably produce under 1,000 units a month. Nevertheless, Thomson Consumer Electronics (TCE) is betting heavily on this line of television sets, because it is the final component in the 16:9 D2-MAC broadcast system, which is preparing the way for HD-MAC [High Definition Multiplexed Analog Component] in 1995. Mass production should make it possible to fill out the product line and bring down the price.

A Concept and a Product

"This is a decisive step. We had a concept, and now we have a product," Industry Minister Roger Fauroux said in congratulating the manufacturers. He recalled that the time for a wait-and-see approach is past. There was a "support policy" to go along with the hardware policy, in the form of satellites like TDF or TV Sat, cable networks that would soon be able to transmit D2-MAC in France and Germany, and test terrestrial broadcasts in that standard.

The problem remains of stimulating a greater selection of programs, which is currently quite limited. Canal Plus and Channel 7 will initially restrict their 16:9 broadcasting to a few films, with Channel 2 going a little further on its satellite channel.

Despite this sour note, Thomson and the ministries involved remain firmly convinced of the soundness of their HDTV strategy. Neither satellite setbacks nor reports of the development of digital technologies in the United States (LE MONDE, 12 Feb) can shake their confidence. "D2-MAC has 10 years ahead of it, with a picture and sound quality that only it will be able to deliver for a long time," a ministerial advisor said. "The first digital consumer products will come out in the year 2000—if everything goes well. Besides, we are not absent from digital HDTV. Two thirds of the HDTV research expenditures of Thomson and Philips (Fr20 billion in five years, including Fr3 billion in government research funding) are not standards-related, since they involve basic technologies."

Mr. Bernard Iseautier, who heads Thomson Consumer Electronics, is also a believer. "D2-MAC is the only current option for providing the consumer with obvious improvements in picture and sound quality. The 16:9 format is going to take hold in the coming years and will account for half of television sales in Europe by the year 2000." With its Space System, Thomson hopes to prepare for the future and consolidate its high tech image—even if it must live with the smaller margins of today's television sets.

Germany: New Philips 2.5 GBit/Sec System Logs First Successful Call

91P60142 Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Feb 91 p 74

[Text] In December 1990, during a visit to Philips Kommunikations Industrie AG in Nuernberg, representatives from Australia Telecom were able to conduct the first telephone conversation using a new technology. Transmission of the telephone conversation was carried out over the service channel of a 2.5 GBit/sec synchronous digital hierarchy (SDH) transmission system. With that, the Australian representatives were able to convince themselves of the successful progress of the development and manufacture of the devices and systems for

the SDH field test to be conducted this year in Melbourne. Delivery of the Philips gear began in December of 1990.

Four repeater stations will be used in the field test which Australia Telecom is to carry out in the urban Melbourne area beginning in April 1991. The results of the test will provide initial significant data with regard to the performance characteristics of SDH systems. The field test is also significant for Australia Telecom since it is [currently] involved with planning expansion of its telecommunications network, in the direction of SDH.

A portion of the equipment configuration to be used in the Australian field test was used in Nuernberg for the first telephone conversation [on the SDH system]. The telephone was connected via the service channel of the SLX 1/16 synchronous line and multiplexer terminal. From there, [the telephone signal] traveled, at a data transmission rate of 2.5 GBit/sec, over a single-mode fiberoptic cable to a repeater and from there further on via fiberoptic cable to a second SLX 1/16 synchronous line and multiplexer terminal. From the second multiplexer, [the signal] made its way into the public telephone network and, by means of a dial-up service, was routed to Melbourne.

The service channel for transmitting coded telephone signals is located in the section overhead (SOH) of the synchronous transport module (STM-1#1). The SLX 1/16 system offers two independent service channels for voice transmission. In addition to selective calling, conference call, group call and all-call options are available. By connecting another [telephone] station to the second SLX 1/16, the call to Australia was expanded into a conference system.

German Institute Develops HDTV Signal Processing Chip

91MI0215 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 29 Jan 91 pp 4-5

[Text] The first digital HDTV [high definition television] laboratory systems built at the Heinrich Hertz Institute (HHI), still using discrete components, were as large as switch cabinets and the heat that they generated during operation could easily have been used for space heating. Their five-kilowatt power loss was greater than the output of two fan heaters.

However, the first step towards miniaturization has been taken. The use of VLSI (very large scale integration) circuits, which present structure widths of only 1.2 micrometers, greatly reduces the volume and power losses of the sophisticated electronics. In practice, this means that where switch cabinets were needed previously, drawers are now sufficient.

If, instead of the semi-customized components largely used by the HHI scientists, they went a step further and used fully customized circuits, which is feasible but only economically viable in large production runs, volume and power loss would shrink considerably further. The electronics could then be accommodated on a printed circuit board. The HHI has already taken the first, trail-blazing steps in this direction. "Now we can think boards for digital systems, too, instead of drawers," as project leader Engineer Maati Talma, describes the new state of the art.

European industry is currently working on similar developments for the analog HDTV transmission process, HD MAC, scheduled for introduction in 1992 for the Olympic Games.

Whereas the first HD MAC receivers, shown at the International Radio Exhibition in 1989, were still the size of two entire switch cabinets, the Olympic receivers will fit into a box the size of a video recorder.

The HMC2 HDTV multifunction chip now produced at the HHI is the first components of a chip system for digital signal processing and was developed as part of a three-year "VLSI for HDTV" research project that is now in its final phase. By the beginning of next year, five more integrated circuits will be available as hardware: a control unit, an input/output chip, a circuit for motion vector evaluation, a 2-D DCT/IDCT [two-dimensional discrete cosine transformation] chip, and an HDTV image memory.

A series of important key components for future digital HDTV systems (such as video recorders and codecs for optical fiber transmission) will thus be available as VLSI chips. The individual components were created in close cooperation with ITT (Intermetall), Motorola, Fujitsu, and NEC. Design and test work was undertaken by the Institute of Microelectronics at the Technical University of Berlin (Professor Manck: design; Professor Berger: chip tests) and the microperipheral research center (Professor Reichl: assembly and bonding technology).

The HMC2 was implemented by Fujitsu on a 10,000-gate ECL [emitter-coupled logic] gate array and can be used as a 150-MHz video signal processor for processing various image signal algorithms that involve multiplications and accumulations. (Comparable commercial components have a clock rate of under 50 MHz). Typical tasks are vector-matrix multiplication, discrete cosine transformation (DCT and IDCT), adaptive FIR filtering and matrixing/dematrixing. At 600 MOPS [mega-operations per second], with two multiplications and two additions carried out simultaneously at a clock rate of 150 MOPS, the HMC2 achieves a data throughput rate of 150 megapixels per second. The chip, mounted on a 208-pin ceramic package, is cascadable if required. Its power loss is eight watts.

"VLSI for HDTV" is one of five research projects being carried out by the HHI's image signal processing department and, like other departments (Digital HDTV System, Standards Conversion for HDTV, HDTV Coding, and Digital HDTV Magnetic Tape Recording), is part of the EUREKA [European Research Coordination Agency] 95 European HDTV research program.

BIOTECHNOLOGY

Hungary's Biotechnology Research Program for 1990's Summarized

91WS0126A Budapest MAGYAR TUDOMANY in Hungarian Oct 90 pp 1158-1170

[An abbreviated version of program titled "Biological Basic Research," prepared by the members of the program council and its scientific councils under the leadership of Gabor Fekete, Jozsef Hamori and Laszlo Orosz: "A Concept for Domestic Biological Research in the 1990's"]

[Text] A program titled "Biological Basic Research" was of special significance in the National Medium-Range Research and Development Plan (OKKFT) for the plan period 1985-90. This was the only program aimed at natural science research, as opposed to the other social research programs aimed at economic, management or concrete goals. Despite this—as can be well seen today—it achieved research results which could be well used (and in part have been used already) in practical areas based on biology (the pharmaceutical industry, biotechnology and environmental protection). But the program had a result much more important than this in that for the first time it brought together all three areas of domestic biological research (molecular biology, neurobiology and ecology) and developed for the first time an efficient competitions judgment system, coordination, evaluation, and supervision.

It is also a chief merit of the program that by providing supplementary material resources it contributed to ensuring conditions for the internationally prestigious domestic biological research work and was of key importance in the development of domestic ecology.

Starting from the successes, surpassing all expectation, a need arose in the experts working in the program council and in its committees at various levels to develop for the next period also a concept for the further development of Hungarian biological research.

Outstanding, internationally valuable results can be expected from Hungarian biological research in the 1990's in the three large successful areas—molecular and cell biology, neurobiological, and ecological research. The concept describes the scientific goals, tasks and international trends of these three areas, turning to the domestic and international contacts system for research. In its present form the concept provides a framework, worked out to the subprogram depth, for a medium and long-range biological research program.

I. Molecular and Cell Biology Research

The concept for the subprogram expands and develops further the very successful research plan still being followed. It proposes expansion primarily in the direction of molecular neurobiology and developmental biology. It emphasizes new points of view, thinking primarily of a discovery of the molecular background for protein-DNA, protein-protein, cell-cell, and cell-macromolecule interactions. It takes into consideration developing biotechnological research, among other things the use of solid phase biocatalysts or transgenic living organisms. The institutional base for domestic molecular and cell biology research expanded significantly when the Agricultural Biotechnology Center in Godollo went into operation in 1989.

Between 1975 and 1985, the most striking development in molecular biology was the discovery of the DNA sequence level organization of the procaryotic and eucaryotic genome. The sequence and arrangement of the DNA segments playing a central role in the regulation of gene function became known but compared to the large amount of sequence information accumulated the knowledge of those protein molecules which can have a special interaction with the DNA signal sequences involved, and which thus are absolutely integral factors of the regulating mechanisms, lagged far behind. In the past three to four years a study of these protein factors has come to the fore of interest. In our judgment research on the protein-DNA interaction will be a very important area for molecular biology in the next five years.

Another research direction of importance for molecular biology as a whole will be a molecular study of the protein-protein interactions. This line has a much older past, but it can claim much fewer concrete achievements at the molecular level.

Basic methods suitable for a molecular study of protein-protein interactions are still in the stage of being developed. With the aid of the technological arsenal of "protein engineering" which is swiftly expanding, this area has unforeseeable prospects. This technology, while preserving all the values thus far of its "parent" genetic engineering, points even further—it offers the possibility of changing protein function at will in a planned direction.

Knowing the macromolecular mechanisms, or the molecular mechanisms of protein-protein interactions, will have a great influence on such "classical" research areas as, for example, membrane research; it will aid a further integration of modern biophysical methods and could bring decisive progress in bioenergetic research.

A study of the cell-cell or cell-macromolecule interactions can be regarded as a special case of protein-protein interactions. This research will be of fundamental importance in a study of the regulation of cell division (growth factors) and the mechanism of differentiation. Significant development can be expected in distinguishing the molecular steps of the event chains initiated by transmembrane signalling and in clarifying the interdependencies between these cascades and cell functions ("from signalization to expression," e.g., immunological signal transmission cascades, development of symbiosis, etc.).

On the basis of the above one can regard as primarily modern and progressive those research themes or plans in the area of molecular biological basic research where knowledge of the biological phenomenon to be studied leads to a recognition of the laws of the molecular interactions mentioned. In regard to the development of methods, we consider the trend which encourages the development of the macromolecular and protein engineering arsenal to have the best prospects.

Chief Themes (Theme Groups), Theme Prognoses

1. Study of the Molecular Mechanisms of Biological Energy Use

Photosynthesis is the energetic foundation of terrestrial life and the only source (continuously renewed) of an atmosphere rich in oxygen. Going beyond a knowledge of the energy transforming biological membranes this is also linked to such important applications areas as, for example, environmental protection and agricultural production (photosystematic efficiency, herbicides).

We can expect a spread of gene splicing technology in the arsenal of methods and the spread of new, highly efficient instrumental analyses.

Of special significance is an understanding of the synthesis of the reducing molecules needed for the creation of the hydrolysis connected with the second photochemical system and of the organic compounds in the first photochemical system and an understanding of the self-assembly capability of protein complexes.

Model studies of bacterial systems especially suitable for genetic manipulations (e.g., photosynthetic and halobacteria) can be performed.

Isolation of and a detailed functional analysis of genes will presumably have a crucial role in discovering the transporter mechanism of mitochondrial phosphate.

A clarification of the role of in situ factors (lipid-protein interactions, macro-organization of complexes, electrical parameters, etc.) is very important.

2. Regulation of Gene Function

This theme group covers knowledge of one of the fundamental phenomena of life. In the living world genes function in an ordered, regulated way in space and time. The question is how this regulation and "order" are realized. Knowing the laws will make possible a deliberate and planned intervention in the regulating processes, and this could bring epochal development in, for example, agricultural production or the fermentation and pharmaceutical industry.

Significant progress can be expected in research on the regulation of transcription by knowing the gene regulation operating in eucaryotic organisms.

Light may be cast on new regulating principles when one understands the symbiosis of papilionaceous plant cells and Rhizobium bacteria.

Identification of the structure of regulating proteins specifically bound to the surface of DNA and of the function of the several structural elements, and a study of the interactions of the various regulating proteins is coming to the fore.

Significant developmental research can be expected by adapting gene splicing technology to industrially significant bacteria and fungus species. More detailed knowledge of the regulating mode in procaryotic and eucaryotic systems, the modes crucial from the viewpoint of fermentation technologies, could bring significant results which could be used in the phermaceutical industry.

Transmembrane-signalling research will lead to discovery of certain regulating basic principles (e.g., responses to environmental factors, development of specific links between cells, etc.).

3. Plant Molecular Biology

The extraordinarily great innovation demand of the swiftly developing modern agricultures indicates the "driving force" of this theme group. The agriculture of the coming century will be based on this research and these developments.

Great progress can be expected in understanding the transcription regulation of plant genes.

The entire area has already gone beyond the level of test plant modelling, there is much research with cultivated plants promising economic profit (e.g., herbicide and virus resistance, quality improvement and even the biological binding of the nitrogen of the air).

The RFLP (DNA long polymorphism) technique has created theoretically new possibilities for plant (and animal) breed improvement. A development of the arsenal for this (DNA probes, computer software) can be expected.

4. Molecular Developmental Biology and Neurobiology

As with theme group 2, the goal here is to cast light on a fundamental question of biology.

Molecular level knowledge of the cell-cell and cell-macromolecule interactions in the regulation of cell division and in a study of the mechanisms of differentiation represents an elemental requirement.

The Hungarian neuroanatomy and biology school has noble traditions which create an outstanding background for adopting the molecular biology approach. Clarifying the proteolithic basic mechanisms responsible for the liberation and metabolism of neuropeptide, understanding the principles of communication between nerve

cells, and studying the molecular and cellular bases of neruoplasticity can be realized with the attitude and tools of molecular biology.

5. The Eucaryotic Gene and the Structure of the Chromosome

The "Biological Basic Research" program in the present cycle supports high level research in this area (under the headings plant systems, animal systems and human applications) which will be carried over into the 1990-95 period.

6. Protein Engineering, Enzyme Design

This theme group is the child of the technologies of the newest period. It seems obvious that with deliberate design man will be able to produce enzymes suiting his needs and with these he will be able to guide the most varied processes and transform and modify materials in the most varied ways.

We already mentioned above, in the section on "General Prognoses," that an explosive escalation of the methodological arsenal for protein design can be expected in the years ahead. This is an area where stressed support for themes aimed at methodological goals is especially justified. We also mean by this those efforts aimed at expanding and managing databanks (DNA and protein sequences, structures, "patterns") and developing suitable software and efforts which contribute to the design of new proteins.

Identifying the "structural patterns" of proteins and knowing their functional role will continue to represent the frontline of research. One must count on a discovery of the factors eliciting or regulating the well defined structuring or folding of the protein chain.

The biotechnology industry being built on molecular biology foundations will need (or already needs):

a. a study of the active center of enzymes which are important industrially or pharmaceutically for the purpose of intervention which is favorable from the viewpoint of practical use;

b. a study of the effect of the quaternary structure of oligomer enzymes on conformation stability and of the development of and causes of the transitionally activated state;

c. a study of the mechanisms of enzyme reactions taking place in a nonaqueous medium and of the factors influencing their speed; a study of the factors influencing the selectivity and speed of microbial membrane transport processes;

d. an understanding of the secretion and transport of eucaryotic proteins in procaryots (e.g., E. coli).

The themes recommended are closely connected to achieving the practical goals connected with solid phase biocatalysts and are aimed at laying the scientific foundation for this.

7. Symbiotic Nitrogen Binding

The nitrogen molecule is a fundamental building block of living material. This nitrogen gets into the material of the living world from the air. However, only a few living organisms are capable of biologically binding the nitrogen of the air; the most important of these are the Rhizobium bacteria and the papilionaceous plants, more precisely a symbiosis of the two (bacteria and plant). So a fundamentally important biological question is involved, and its agricultural significance is similarly great (for example, replacing nitrogen artificial fertilizers with environment friendly technologies).

The "Hungarian SZBK [Szeged Biology Center] school" cultivates domestic molecular biology in this area, and it is best known even internationally. Going beyond the foreseeable or long-range practical utility of the theme (replacing artificial fertilizer by effectively binding the nitrogen of the air) the theme also makes possible a model study of a number of general theoretical biological problems, such as differential gene activity, different methods for regulating transcription in procaryotic and eucaryotic cells, elements and processes of specific communication between a plant cell and a bacterium cell, the molecular background of the evolution of the gene, etc. Beyond all this the area also provides a great possibility for continuous, general methodological development.

8. Immunological Research

Even compared to its noble past immunological research has gone through a dramatic change in the past 10 years. Technical development illuminated the horizon of "classical immunology." Not only is the process of eliminating "alien" proteins, virions, bacteria, etc. being disclosed to us in ever greater detail, but research has contributed fundamentally to clarification of the gene concept. Direct practical uses (medicine, diagnostics) have developed very quickly too.

The themes currently being developed are internationally recognized, and their further development is well founded. With further research on the role of the B lymphocytes in the "signal transmission" cascade of the immune system one can expect a clarification of the role of the T lymphocytes to come into the foreground. In addition, cultivation of the theme may bring us closer to an understanding of such general problems as cell-cell, growth and differentiation factors-cell and ligand-receptor interactions and the mechanism of signal transmission. Such a development of immunology also opens new paths in the area of practical use. We might mention as an example that efforts aimed at development of therapeutic manipulations, and new type vaccines today see real prospects in manipulations at the level of the T cells in addition to modifying the antibody response. It is also important to stress the production of traditional and

monoclonal antibodies which can be used widely by other branches of science as well.

II. Neurobiological Research

A multidisciplinary character is today a general characteristic of neurobiological research. The traditional special areas are gradually forming a unified nerve science, and individual research projects are characterized by a manysided approach. The joint work of teams consisting of experts trained in various areas will be ever more common. Often these teams will be made up of researchers from various countries.

The methodology of neurobiological research went through a very great development in recent years. As a result of this development the complexity of instrumentation increased to a large degree and the use of developed technical methods became a basic condition for effective research. It is becoming possible to have as a goal the discovery of finer and previously hidden mechanisms of nerve function. This research not only serves to enrich our natural science information it can also be used in practice.

The various nervous system processes are closely interdependent with one another and require the coordinated use of various methodological procedures. In the future this complex approach will also aid the analysis of such problems as, for example, the development and ageing of the nervous system, the question of regeneration and functional restitution, the genetic regulation of elementary nerve structures, chemical components, and functions, and how this regulation is realized. We must emphasize the importance of an approach which has many levels (molecules, cells, cell systems, regulation of life processes, behavior and psychic function) and is many sided (morphological, biochemical, pharmacological, biophysical, neurophysiological, phylogenetic, psychological, etc.).

Chief Themes (Theme Groups), Theme Prognoses

1. Research on the Chemical Materials of the Nervous System

In the past few years there has been significant progress in connection with an understanding of the chemical materials playing a role in the integrative functioning of the central nervous system, transmitter amino acids, neurotransmitters and neuropeptides, primarily in learning their chemical nature, in their nervous system distribution, and in mappings connected with path sytems. Considerable new data have appeared concerning these chemical materials in connection with some basic, integrative functions aimed at maintaining the individual or the species. But these data still do not give answers to a number of basic questions. In connection with this, there is a need to further clarify the biological effect and function of the large number (more than 50) of neuropeptides identified in recent years, the effect and function of their derivatives and fragments, in central and peripheral regulation of the endocrine system, in coordinating the nervous system integrative functions, and in the basic life functions coordinated in the interest of survival (for example, in obtaining nutrients, in integrating behavioral reactions controlled by various motivations, and in learning and memory processes).

In addition to learning about the natural bioactive molecules themselves, there is great theoretical and practical significance in research on those pharmacons capable of influencing the synthesis and breakdown of natural materials and those which can act as agonists or antagonists of their cell receptors.

The practical clinical significance of the new natural and artificial bioactive molecules, primarily their neurological, psychiatric and endocrionological significance, is also obvious. They may effectively aid an understanding of the pathomechanism and thus aid diagnosis and therapy.

2. Research on Neuroendocrine Regulation; Production of Neurohormone Analogs and "Super Hormones"

The rich domestic antecedents provide a good basis for this research.

The following are of special significance from the viewpoint of neurobiological research: the gonadotropin releasing hormone (GnRH) and its analogs, somatostatin and its analogs, and the growth hormone releasing factor (GRF) and its analogs. The gonadotropin releasing hormone also has very important central nervous system functions as a neuromodulator or neurotransmitter. Research is directed primarily at producing new GnRH analogs; with these the many complex physiological functions of GnRH can be isolated on the basis of a study of the structure-effect interdependency.

One of the physiological functions of somatostatin is to hinder the release of the growth hormone, so the design and production of somatostatin antagonists is especially important from the viewpoint of stimulating the release of the growth hormone. The somatostatin agonists, on the other hand, are of special significance in treating neuroendocrine disorders, motor function disturbances and certain hormone dependent tumors. GRF specifically increases the secretion of the growth hormone, but it has no effect on the secretion of other peptide hormones of hypophysis origin. The purpose of chemical synthesis is to produce analogs with a long lasting effect with which we might get imoportant clinical diagnostics. Use of GRF analogs might also be of extraordinary significance in increasing the milk producing ability and growth of cattle.

3. Neuroimmunological Research

The relatively new area of neurobiology is a link between the nervous system and the immune system. In part this is also linked with the functioning of the neuroendocrine system. The nervous system role of the transmitters,

neurohormones and prostaglandins cooperating in certain functional states of the nervous system in influencing the reactivity of the immune system under physiological or pathological circumstances is little understood.

4. Analysis of Elementary Nervous System Processes

Those structures and molecular processes which play a role as small and large molecule stimulus transmitters and in producing, storing, liberating, and inactivating modulator materials are especially significant. Research must be done on those changes which take place in the internal chemical, morphological, and biological processes of nerve cells when specific inputs are activated or as a result of various exogenous agents.

A study of the effect on membrane function of transmitters, modulators, pharmacons, and harmful environmental materials could aid an understanding of nerve function and of the toxic effects. This latter question also has environmental biological significance.

Research on the liberation and elimination of stimulus transmission materials and modulators could lead to an understanding of chemical and non-chemical communication. Study of the development, determinism, plasticity, weakening or ending of the functional connections between cells and of the identical or different roles played in these processes by the neurons affected is an important research area. An understanding of the connections between cells will bring closer an understanding of elementary sensory, integrative and learning processes.

With the increase in harmful environmental agents there will be an increasingly urgent need for an understanding of the direct harmful effects directed at nerve cells.

5. A Functional Anatomical Analysis of More Complex Neuron Nets

A precise qualitative and quantitative determination, taking into consideration transmitter and receptor distribution, of internal connections or input-output relationships could provide a foundation for memory and learning research (at the nervous system network level) and for the neuro-computer research program which will hopefully evolve. Network research could clarify the parallel functioning in the nervous system, the significance of such functions and their role in replacing one another. Research on behavior and learning at the network level will bring closer an understanding of the processes taking place in more differentiated nervous systems.

6. Behaviorial (Psychophysiological) Research at the Molecular and System Level

The recommended research areas are:

A further analysis and systematization of the somatic and vegetative correlates of psychic processes (emotional, motivational states, sensory and cognitive processes, etc.). The results of this research could very effectively aid psychosomatic medicine as well.

Direct brain study, primarily electrophysiological (EEG, event dependent, eye movement, etc. potentials), of psychic functions.

Neuropsychological studies, an analysis and systematization of psychic functional changes following damage to certain areas of the human brain.

Ecological Research

Environmental biological problems are thickening throughout the world, thus in our country as well. The chief causes of this here are the relatively high population density and the extraordinarily high ratio of agricultural areas compared to the total area. Even considering the frequency of occurence of local and regional environmental defects and crises the situation in our country has deteriorated greatly in the past two to three years. Even after long years a significant forest destroying process has not ended and the souring of the soil as a result of acid rain and use of artificial fertilizers with a souring effect continues. The nitration of ground waters has taken on alarming magnitude. There is hardly a biocenose in which degradation processes have not started. It is just as harmful that genetic variety is decreasing in many animal and plant populations. On top of all this the dangers deriving from the global transformation of the environment are increasingly threatening as well.

The program outlined below could provide an opportunity for us to come closer, by a development of the theory of ecology and of a methodology resting on the theory, to discovering the ecological mechanisms of environmental defects and catastrophes so that in concrete cases we might be able to work out preventive, interventional and decision recommendations for the government.

Looking back over the three year period between 1986 and 1988, it can be said that it was of key importance in the development of Hungarian ecology. In the latter years there was a turnaround in approaches as some of the themes being studied showed a less indirect connection with practice. There can be no doubt that the OKKFT program "Biological Basic Research" and the ecological subprogram realized within it contributed greatly to financing successful research. So we offer in what follows only an abstract of the more important results achieved within this framework and not at all a complete listing. But even this short list illustrates the many types of domestic ecological research.

Crop protection ecology took serious steps, primarily thanks to a recognition of the mutual interactions of phytophagous and zoophagous organisms, which plays a key role (thus it was possible to work out, for example, a useful parasite treatment procedure in apple orchards).

New proof was obtained to support the acid rain hypothesis for the oak destruction and the details of the mechanism. Progress was made in regard to the intestinal bacteria communities of the arthropods and worms living in forest soils which are significant in the breakdown of organic materials. By studying the soil zoology conditions for the decomposition of needles and fallen leaves in planted pine forests we advanced our knowledge regarding the stability of the plant-soil system. It was established that the common food supply and a similarly regulated life cycle develop the guilds (the combination of species with similar functions) of the communities of Lepidoptera consuming oak foliage. For the first time in Europe they successfully studied picoplankton at Lake Balaton and clarified its role in creating the biomass. They more precisely determined the role in production of planktonic crustaceans, important in the material exchange of the Balaton. They clarified the nutrient spectrum and preferences of shad and the material and energy turnover significance of bream. They achieved new results in research on the indicator organisms of the Danube, in interpreting the indications of the several species and in discovering the structure of the biological communities and the system of material exchange connections. They demonstrated that the deterioration resulting from the overuse of xerothermic meadows, and the changes in the dominance sequence of species are accompanied by unfavorable changes in internal content values. They established air and soil pollution tolerance values for urban tree species. They developed a method for element analysis comparing air pollution indicator lichens. New results were obtained in interpreting the role of the structure of sowings in regulating ecophysiological processes. It was shown that in our shallow waters with a large buffer capacity the role of elemental sulphur is the key to sulphur exchange changes modified as a result of environmental pollution. In the course of a study of plant-microbe interactions they isolated more than 300 microorganisms from the rhizosphere and phillosphere of red clover, wheat, alfalfa and soy, including many which proved antagonistic to pathogens and pesticide tolerant. Progress was made in mapping the domestic Rhizobium populations and in selection of active Rhizobium cultures. The theoretical foundations for a community approach to nature protection were further developed; it was shown that it is also useful to judge conservation questions on the basis of isolate-dynamics. A nature protection value listing of all domestic vascular flora was prepared. There were new findings in regard to model making and stability interdependencies in plant associations.

Effective handling of ecological crises presumes developed basic science. Today, when we are already beyond many case studies, we see well that a deliberate development of theory and of the array of tools, in harmony with theory, is indispensable. How supraindividual systems consisting of several populations and many individuals react to external warping effects depends on the degree of organization of the system. Thus far our knowledge about the degree of organization of the communities is deficient. Frequently the degree of organization is manifested in the dynamic behavior of the system. For us the crucial characteristics of the systems studied are stability, resistance, flexibility and the directedness or regulated nature of developement. The directing processes are tied to certain structures; special attention must be turned to these.

It can be stated without exaggeration that without a discovery of the laws of supraindividual organization it will not be possible to preserve living natural resources, to manage them optimally over the long run or to find new resources.

Organization, and the concepts related to or connected with it, constitutes our program and the chief trends given in the titles, gives it unity and makes possible the interchangeability of a good part of the methods and theoretical results, even if the emphasis on the theoretical or applied character differ in the several chief trends (theme groups).

The appearance of the new chief trends in our thematics indicates a recognition of the importance of applied ecology questions. We refer here to, among other things, the package of agro-ecological problems accompanying the social-economic changes, to the domestic tasks of the International Geosphere-Biosphere Program (IGBP) taking form in powerful international cooperation, to theoretical and practical questions of ecological monitoring and environmental diagnostics, and to the microbial ecology chief trend connected with other trends in biology. The large time interval case studies requiring constant monitoring (e.g., the ecology of standing and flowing waters) indicate continuity with the preceding research period; these aid the testing of theories by providing uniquely long and reliable data series, and their practical significance is great as well.

Chief Themes (Theme Groups), Theme Prognoses

1. Theory and Methods of Ecology

It is absolutely necessary today to build a sufficiently generalizing, coherent ecological theory, taking into consideration the more important part areas of ecology, and to develop methodologies and tools consistent with the theory. The already existing mathematical models (niche theory, population and association dynamics, ecophysiological and evolutionary ecological models) should be developed further.

Creation of simulation model families and databases to serve them and operative and unifying, harmonizing software development are desired to lay foundations for ecological predictions. The processing of data representing supraindividual models and processes requires the development of computer program packages, and their constant maintenance, which, by a further development of standard multivariable statistical procedures, will better take into account the characteristics of taxonomic and ecological data structures.

2. Research on Organization Mechanisms

A description and modelling of basic structures and processes is of key importance in understanding supraindividual organization. Spatial structures (of population collectives and associations) and other structures must be recognized as aspects of the dynamism of supraindividual systems in plant, animal and microbial communities which differ greatly in trophic level, place fixity and physiognomy. The causal background models should be studied in parallel. All this, naturally, will be accompanied by a development of the array of tools and of the mathematical-computer methods of description. The dynamic peculiarities of living communities must be specified and generalized. This will require the most varied case studies from specialists and it will require model development activity. The control processes tied to structures must stand in the center.

3. Population Biology—Association Dynamics—Evolutionary Ecology

Since stability and control are basically dynamic concepts the domestic spread and development of the dynamic aspects of ecology are most necessary.

So we must move toward the development of models and procedures which can be used in the area of population biology, association ecology, succession research and coevolution. A more effective interconnection must be created between population dynamic, cenological, and system theory models and methods. Evolutionary ecological research (life cycle evolution, optimal feeding strategies, social organization, interactions between genetically heterogenous populations, a study of evolution in niche space) should be made more profound. In the course of this population dynamic, demographic, and population genetic methods should be further developed and integrated. The results may be used in forest management, meadow and pasture management, nature protection and crop protection (biological control).

4. Taxonomic Background Problems of Ecology

A necessary condition for ecological research is a sure species level identification and the existence of taxonomic bases. The identification bases today—in regard to both plants and animals—is weaker than it was a few decades ago from both the personal and institutional side.

The "general auxiliary science" character of taxonomy does not mean that it does not have an internal, autonomous developemnt as a branch of science. An important condition for the development of domestic taxonomy is to strengthen the plant population genetics research done thus far and the population genetics research done on animals. This is also tied in with the biological research laying the foundation for methods to establish and maintain gene banks. The existing domestic fauna databank should be strengthened further and the flora databank should be extended.

5. The Ecophysiological Foundations for the Adapting of Natural Plant Populations and Cultivated Plants and Their Connection With the Ecological Potential of Hungary

Some of the investigations have immediate practical significance, for example those which deal with the adaptation of cultivated plants to climate, soil factors and existing stocks and thus cast light on the efficiency of the exploitation of ecological environmental factors or, for example, those which cast light on the ecophysiological background for the competition between cultivated plants and the weeds which damage them. Research on natural living community populations constitutes another category of research. By knowing the ecophysiological peculiarities of populations (photosynthetic activity, water housekeeping, nutrient turnover, etc.) we might come to an understanding of resource utilization and resource distribution and to a physiological explanation of association organization.

6. Ecology of Standing and Flowing Waters

Fundamental changes have taken place in the biological condition of our surface waters with changes in plant nutrient load and organic material load and with the influx of toxic materials. So, going beyond a cenological survey of our standing waters and of the most important living organism associations of our smaller streams, it is necessary to survey the turnover and effective mechanisms of nutrient burdens and limiting materials at various trophic levels. We must see to it that these processes can be modelled mathematically. This research has very great practical significance from the viewpoint of water supply, preserving the self-purifying ability of waters, fishing and tourism and in certain cases from the viewpoint of nature protection as well.

7. Domestic Tasks of Global Ecology

Domestic ecology can link up with the International Geosphere-Biosphere Program, created to study the global questions appearing in such magnitude, primarily via the observing stations, the so-called Geosphere-Biosphere Observatories.

The analysis on various scales of the observations and a mutual interpretation and fitting together of them is an unsolved task in many areas; resolving the difficulties (e.g., discovering the regional representation of global phenomena or the problematics of model and scale and, in connection with this, the development of scale invariant models or models expressing scale dependence) is a theoretical task. We need to recognize—with paleoecological methods—the time dynamics of large time scale ecological events.

8. Environments Influenced by Human Activity, and the Interaction of Natural and Manipulated Communities of Microorganisms

The future theoretical and practical significance of this area, thus far neglected, can hardly be exaggerated. Thus,

there should be an analysis of the relationships between the genetic determination of microbial communities and the ecological influences on them. There are practical questions awaiting solution. Among others: To what extent does the survival of artifically manipulated organisms introduced to render harmless wastes and harmful biotics have undesired environmental effects? How can we influence in a stable way the rhizosphere microbe communities of our economic plants in the interest of increasing yields, and what effect will this have on the life of the soils? What community mechanisms play a role in microbiological crop protection techniques? How can two or more microbe strains be cultivated simultaneously for biotechnology industry purposes?

9. Ecological Monitoring For Judging the Status of the Environment

Timely recognition of the condition of the natural environment, of the plant and animal populations, and of changes in their condition requires a development of the sampling, analysis and decision preparation methods of ecological monitoring.

Research is also necessary in regard to the utility of aerial and artificial satellite monitoring systems, but a solution of the methodological problems of traditional earth surface monitoring is most important. Procedures with a favorable cost/profit index should be developed. The so-called index-methods should be developed primarily. Data evaluation procedures should be perfected (map analysis methods, special multivariable procedures, computerized models). The possibility of using computerized expert systems to help practical nature protection decision making should be researched.

10. Ecological Foundation for Nature Protection

Our natural environment, the plants and animals living in the wild and the communities of them, are parts of our national treasure, so principles for their preservation must be laid with ecological research. Unfavorable changes have taken place in most of the natural life communities; they have taken the path of ecological degradation. The relevance of supraindividual organization is great here, and nature protection projects offer good reference possibilities.

The chief areas and problems to be researched are: the theory of island biogeography, which is connected with the size, form, etc. of reserve spots; habitat fragmentation; invasion problems; population biological, demographic, behavior ecology, and population genetic questions; the finer structural events in living communities (e.g., changes in diversity) or functional changes (e.g., trophic connection changes), which could be precursors of species extinctions; development of management guides suitable for long durations; etc.

11. Ecological and Biotechnological Foundations for Agricultural and Forest Management Production Systems Which Are Adaptive and Which Can Be Maintained for a Long Time

The fundamental laws for the organization, stability and control of ecological systems are just as valid in agriculture as in natural living communities. By applying our findings in theoretical and experimental ecology we must seek, in close cooperation with the agricultural sciences, a way to develop production systems optimally adapted to the environmental factors.

The especially important areas are: biomass management, factors determining soil productivity, integrated crop protection, energy conserving and environment friendly procedures, microbiological and biotechnological procedures, a theroetical and experimental study of organic farming systems, population biology of weeds, possibilities for adapting to dry conditions in farming, and simulation and experimental realization of complex ecological-farming systems.

12. Principles for an Ecological Study of Industrial Activities Accompanied by Large Scale Environmental Burdens

A methodology for the prior impact study of nuclear power plants, hydroelectric plants, surface coal mining, deep mining, etc. has hardly been developed even today. It is also absolutely necessary to develop basic principles and operating principles for the monitoring network to be built afterwards. A number of scientific areas and professions have to be coordinated and applied ecology has an important role in this work.

A few typically ecological tasks are: measuring the tolerance and reaction of the natural plant cover and fauna which have developed in the vicinity of the intervention; working out microbiological foundations for making the soil of waste dumps productive; an autoecological study of trees to be planted (e.g., in regard to heavy metal tolerance in toxic slag and sump fields); the question of optimal sequences (minimizing the length of the secondary succession series); etc.

Realizing the tasks listed above can be imagined only if we build up a suitable informatics background and create an institutional base for modelling and data evaluation.

The need for the background information indispensable for ecological research and the need to make modern use of the swiftly accumulating information absolutely require that the existing information databases become accessible to ecologists (professional literature, meteorological databases, soil study, geological, cartographic, remote sensing, etc. databases), and that a modern, new, computerized database of specifically ecological data and information be created and constantly maintained. This could serve not only the cultivators of our professional area but also—thanks to its public nature—other researchers and organizations (such as agriculture, forestry, environmental protection, regional planning, etc.).

Each of the areas to be developed listed above might need and could use a new international institution. What is needed is an institution with an ecological orientation,

task oriented and operating with applied systems analysis methods, with changing personnel and an international atmosphere, open to both East and West.

COMPUTERS

EUNET UNIX Network 'Backbone' in Hungary Established

91WS0198a Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 24 Jan 91 pp 13-14

[Article by Istvan Dalicsek: "UNIX Backbone at SZTAKI: European Connection"]

[Excerpt] Since April 1990, Hungary has been a full member of the UNIX communication network called EUnet, and it thus has the opportunity to operate its own national center. This center has been established at SZTAKI [Computer Technology and Automation Research Institute].

EUnet is a UNIX based computerized communications network covering Europe which has been operating since 1982 under the auspices of EurOpen. Thus it is the oldest of such European networks. A hundred thousand users of 1,300 institutions of 20 European countries make use of its services and can reach the one million users of the UUCP system, a UNIX network embracing the world, and other international networks. EUnet is open for users in Europe whether they are scientific research institutes or economic organizations. Its daily traffic comes to 30,000 messages and 1,500 thematic "News" articles.

Graphtopology

Every connected country has its own national center which is called a "backbone." In their own countries these centers take care of administration and offer computer services for the connected units (or nodes). These national centers are connected with one another in an almost complete graph form, providing the network infrastructure. The units connected to the national network center make up a tree structure. Swift and simple route designations are possible with this network topology. The European backbone, which can be found in Amsterdam at the Centrum voor Wiskunde en Informatica, provides transmission for large volumes of data and provides the gateway functions. This SunSparcStation type configuration has the speed and background memory needed to carry out the task.

EUnet offers many types of services. EUnet mail is the well known electronic mailbox. It provides swift communication from mailbox to mailbox. A message can be sent to the address of any computer which is connected to any more significant communications network. At present there is access to the following networks: ACSnet (Australia), BITNET (North America), CSnet (North America), EARN (Europe), EuroKom (Europe), HEPnet (world network), Internet (world network), JUNET (Japan), JANET (Great Britain), NORDUnet (Scandinavia), X.400 (Europe) and UUCP (USENET) (world network).

EUnet News is an international forum for the exchange of information. It also makes possible the comparison of opinions on various subjects. Users can select among 400 theme groups among which one can find computer technology, sociology or graphic arts. One can enter articles or even programs in a given theme group, can ask questions, can debate or simply read. Very many users like it because they can get loads of free (public domain) programs.

EUnet Archive stores its articles and programs longer than News. One can get a special program assortment from the archiving workstation so one can be sure of getting the latest version.

Inter EUnet is a new service which can be accessed in only a few countries so far. It provides a high speed dialog connection and other services which previously could be used only in local networks. This reduces the time for messages to reach their destination to a few minutes. Its basis is the well known TCP/IP protocol. Broad access to it can be expected in the early 1990's.

Hungary: Computer Virus of Chinese Origin Described

91WS0130A Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 6 Dec 90 p 5

[Article by "the VirusBusters": "What Happened to Margareta? An Invader From China"]

[Text] On 24 October we got a report from the Margareta Package Dispatching Service about the appearance of a new virus. The virus is called Invader, a further developed version of Plastique. Since its first occurrence it has appeared in a number of Trans-Danubian and Budapest computer nets, causing serious problems and system outages. According to the international literature the virus appeared in China in September 1990 (as far as can be established). It was probably transmitted to Hungary by Taiwan computer vendors. It is extraordinarily difficult to detect and it spreads very quickly.

Despite the relatively great size (4,096 bytes) of the virus code it also contains several errors and one can tell unambiguously from a few code details that its author was acquainted with the Jerusalem (Friday the 13th) virus, and even took a few parts from it. The virus infects files with the COM and EXE extensions but is also dangerous to the boot sector of every type of floppy and hard disk. The infection of the several units is not always perfect. In the case of files with the COM extension the 4 kilobytes of virus code are inserted before the program (similar to the Jerusalem virus). But it does not infect COMMAND.COM, the DOS command interpreter.

In an infected file the original program begins at byte 4096. If the original size of a COM file exceeds 60 kilobytes (the maximum length cannot be more than 64 kilobytes—the editors) there is no infection but due to the attempt the operating system cannot go into a definite state, that is it may get hung up. If the virus goes into a file with the EXE extention it may go into the middle, not only the beginning or end of the file as with all types seen in Hungary thus far, and if it does it immediately destroys it.

The virus reads the length of the file from the directory of the EXE file. For many types of EXE files this value does not agree with the real file size. In this case the end of the file, according to the data read out, is written over by virus code and the file is so damaged that in principle it cannot be restored. When such files are run the virus executes itself but then the original program either hangs up or could run even without error depending on what part of the original program was overwritten by the virus.

It may be that the pseudo file length is longer than the real length. In this case the program is not damaged but it runs after the virus goes into memory. Most often, however, the recorded and actual file length agree. Then the size of the file increases by 4,096 to 4,110 bytes. The EXE and COM files are distinguished by the virus on the basis of their extensions, which differs from DOS which decides this on the basis of the first two bytes of the ID field of the file (EXE in the case of 4D 5A). But since in DOS the EXE files can be renamed COM and vice versa without changing how they run this causes certain problems for the virus. A COM file renamed EXE is destroyed unrestorably because the virus regards the beginning of the file as the EXE directory and treats the code here as data. As a result, for example, the file length could be any size. On the other hand EXE files renamed COM can be restored.

If they are infected both the EXE files renamed COM and the COM files renamed EXE become unrunnable. The infection itself takes place (in the EXE and COM cases) at the time of running or when the file is opened, so a COPY command given in an infected environment infects both the source and target file. In Novell NetWare networks files with the Execute Only attribute can also be infected. (Version 5.01 of the CHKVIR program is capable of checking files with the Execute Only attribute and in case of infection it can eliminate the virus.)

On a hard disk the boot sector of the first boot partition is rewritten (this can generally be found in the first sector of the first cylinder of the 0 head). The virus code and the original boot sector go into band 0.

On the basis of the documentation the 67C-s version of John McAffee's SCAN program, the most generally used virus seeker in Hungary, recognizes this virus but it does not find it in the boot sector of the hard disk. In every other case a search done with it is successful.

The virus writes over the boot sector on a floppy disk too. Here the virus code and the original boot sector go onto the band after the last. Naturally this band is invisible to and cannot be used by DOS, so it must be prepared before writing in accordance with the FORMAT command of the system. It is also possible to format a band in the operating system, and floppy disk drives in general are capable of reaching one or two bands after the last (39th or 79th) band. But a few 386 and 286 computers format the band after the last only faultily. For this reason—since the boot sector was overwritten earlier—the original boot sector is lost. Then, when starting from the disk, the system cycles trying to read the band after the last, which naturally cannot succeed due to the faulty formatting.

The situation is different if the boot sector was infected earlier with the Disk Killer virus. Then the Invader seeks the original boot sector stored by the Disk Killer and infects it. It is well known that the DOS messages and the names of the hidden system files can be found in the boot sector of both hard and floppy disks. After infection, deviating from a "healthy" boot sector, the textual part can be found not at the end of the sector but rather at the beginning.

When the first infected program is started or with a system start from an infected boot sector the virus goes into memory and stays there, occupying 5,120 bytes of space. Its presence in memory can be detected via DOS. If the Disk Killer became memory resident earlier it renders it ineffective but it itself cannot be erased by the Ctrl + Alt + Del keys. It can be removed only with the Reset key or by turning the computer off and on.

The noxious effects are the following. About 30 minutes after the first infected file is run the computer plays a melody; during this the system can still be used. After a warm start, in a few cases, it overwrites all the bands beginning with the first band, and does so on every accessible disk unit. Then the following message appears on the screen: "PLASTIQUE 5.21 (plastic bomb) Copyright (C) 1988-1990 by ABT Group (in association with Hammer LAB). WARNING: DON'T RUN ACAD.EXE!" The destroyed sectors of the disk units also start with this text.

If certain conditions are met the content of CMOS RAM is also overwritten and the processor is made to stop. Then the computer hangs up and cannot be used even after restart without a correct overwrite of CMOS and a reformatting of the hard disk.

Compared to viruses which have appeared in Hungary thus far the Invader is much more destructive and harder to discover, and it spreads more quickly.

More detailed information can be obtained from the HVBT (the Hungarian VirusBuster Team) at telephone number 166-4011/2752.

Analysis of Videoton Performance, Strategy Continued

91WS0129A Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 12 Oct 90 pp 1, 13-14

[Unattributed article: "The Investigation Is Completed—We Have Not Forgotten"]

[Text] In the most recent of our articles following the fate of the largest state electronics enterprise ("Videoton Is Not on the Floor, But It Must Get Up By Itself," CW-SZT 90/36) Adam Torok, chairman of the Supervisory Committee, gave a picture of Videoton in his own words in the wake of the investigative report which had been prepared, after which the report itself was declared secret by every interested party. At the time we presumed that after the expiration of the 30 day period allotted the leaders of Videoton to make their objections, the minister would report to the press about how to put the enterprise on its feet and that details of the supervisory committee's report would be made public, taking into consideration the many interests involved, if for nothing else then as a lesson.

We waited for all this in vain. By way of solving things—and without making any additional information public—Peter Bod named an enterprise commissioner, in the person of Laszlo Akos Garami, to the position of Janos Kazsmer, who had resigned. In the meantime the minister has told everyone, from the interest representation groupings organizing a demonstration to the ever more impatient press, to turn with their questions and problems to the enterprise commissioner. He is responsible in Videoton matters—until his commission, which is for a definite time, expires.

Our journal, which has tried to provide information about the Videoton crisis objectively (on the basis of documents), cannot, after so many analytical articles, abstain from describing the report of the Supervisory Committee. As early as August we asked the former director general to help designate those parts of the report which did not hurt Videoton's business policy or strategic interests, but Janos Kazsmer considered the entire document confidential. Too bad. On the basis of reliable sources, however, we can form a faithful picture of the report. We can now inform our readers, in the following summary, making up almost half of the original document, how the Supervisory Committee evaluated the critical situation of Videoton.

The new Supervisory Committee, formed on 9 July 1990, received as its first task a study of the situation of the VEV [Videoton Electronics Enterprise] and enterprise group, according to the views presented, and then to make a recommendation as to how the government could cooperate in handling the crisis of the enterprise group.

The Sphere of Authority of the Study

Legally the study could extend only to the VEV as it is the only member of the enterprise group under state administrative supervision. The other members of the enterprise group—at present at least twenty—work in company form and formally only the ownership connection ties them to the VEV. It is not possible to give a precise number for the members of the enterprise group because the data requested from the VEV regularly differ from one another.

A study limited in principle to the VEV naturally would have made a survey impossible, for production does not take place in the VEV, with its few dozen employees it would appear to be a small enterprise. In reality, of course, the VEV supervises all the activity of the enterprise group, by virtue of its ownership position and personal ties, and does so in such a way that it plays a key role in developing the international contacts of the members. In practice foreign investors also reach the enterprise group through the VEV.

In August 1990 the VEV and most of the members of the enterprise group were in a catastrophic financial situation; for example, the combined tax debt of the group totaled about 5.5 billion forints. About 80 percent of this burdened the Videoton Company, by far the largest member of the group. (But because of the structure of the enterprise group and the legal status of the Supervisory Committee, the Supervisory Committee can make recommendations directly only in regard to the VEV.)

According to the present leadership of the VEV the enterprise and the enterprise group need urgent and large scale state aid to survive, and this should include "nullification" of the entire debt of the VEV, forgiveness of past taxes, considerable trade policy aid to maintain the export to the Soviet Union and state concessions above the customary and legal size for the direct foreign investment being realized or desired by the enterprise group.

But under the present organizational conditions of the enterprise group utilization of the desired aid cannot be tied to guarantees free of contradictions. Formally the members of the enterprise group (primarily the Videoton Company) would profit from a large part of the aid going to the VEV. But the government could ask for an accounting on their utilization only from the VEV. As with the enterprise transformation policy started in December 1988, where a good part of the enterprise property got out from under direct government control, so that there was a "property salvation" which could be attacked legally only in certain details, here also there could be no obstacle to unsupervised use of the aid. This is true not only of the direct financial aid expected in the form of debt forgiveness. It is probable, for example, that the VEV itself would distribute the quotas going on the list fixing Soviet export quotas for "exceptional" products, and thus would distribute the dollar export possibilities among the member enterprises of the group.

For employment and other reasons the cooperation of the government in solving the enterprise and enterprise group crisis is indispensable, so there should be an enterprise group structure in which the aid can be minimized and its use well supervised. It must also be ruled out that there should again be at Videoton a "large enterprise" crisis making state intervention necessary in the future. So before describing the concrete results of the study we should say how the state aid could be effective in a new enterprise organization in which the obligations and the rights and profits attaching to the state property share can be clearly distinguished while letting the market pass judgment on the functioning of the several producing units. Then it will be possible to see clearly which unviable parts should not be maintained by the owners—including the state—of the several separated member enterprises. It is a very absurd aspect of the present situation that the state ownership function at the VEV consists primarily of its—still only expected—supporting savior role, and before all else the study should cast light on the background of this.

Processes Producing the Crisis Situation (1987-1990)

The organizational structure of the enterprise which remained unchanged for two decades came into being at the beginning of the 1970's with the triad of the TV Factory, the Radio Factory (with the military plants) and the Computer Technology Factory. Beginning in the middle of the 1980's the enterprise leadership felt that this structure was no longer a source for energies serving growth. At the same time the obvious presence of the military profile made it difficult to attract foreign capital, and it was felt concerning certain other profiles that it would be better to deal with them in a small enterprise framework.

They began to work out a concept for reorganization in 1987 and they took the first steps in December 1988, a few days before the association law went into effect. It is worthy of note that virtually at the same time the enterprise completed one of its best economic years (if not the best). In 1989, the first year of the already functioning new enterprise organization, they faced a double challenge deriving from the cutback in Soviet military and civilian export. One cannot judge precisely how effects deriving from the transformation influenced the growing balance and operational problems of the enterprise. But it is a fact that the organizational transformation was taking place while the crisis deepened further. The impression is hardly groundless that the enterprise leadership sought in an acceleration of the transformation process one cure to the proliferating problems.

As of August 1990 about 4.5 billion forints of foreign capital had been drawn into the enterprise group, and this includes the Hungarian-French Informatics Limited Liability Company. But some 1.37 billions of this capital is not of Western origin but rather is the Kamaz share which has a contrary effect in regard to its macroeconomic effects (not increasing the domestic convertible foreign exchange financing sources but rather indirectly increasing the budgetary expenditures, and it is true that the counter-value for 60 percent of this share has not yet been transferred). About two thirds of the remaining part comes from the Waltham firm, or its interests, which has a de facto interest in Videoton, if not de jure.

This solution made possible the creation of mixed enterprises meeting the formal rules, the Videoton group also got a profit tax concession, and its Western market contacts undeniably expanded. But by virtue of the Waltham connection Videoton was able to "get back" hardly more than the more than 21 million German marks assigned to the FRG firm in 1981 by permission of the MNB [Hungarian National Bank], and this contact did not greatly help the leadership-technical-organizational renewal of the enterprise either. It is also a fact that even today the Hungarian enterprise has not obtained a documentable ownership share in Waltham under the heading of the assigned sum.

The Financial-Management Situation of the Enterprise Group

The tangled nature of the management of the Videoton Company, and thus indirectly of the entire enterprise group, is well characterized by the fact that an auditing report signed on 9 May 1990 by an auditor from the Ernst and Young Bonitas Company concerning the 1989 balance of the Videoton Company closes with the statement that "... since the leadership does not want to mark down the inventories and cannot provide an itemized list of deliveries and since the correctness of the rent payments (to be paid to the VEV—the editors) is doubtful we cannot give a clear opinion, without reservations, about the 1989 financial accounts." Going beyond this the auditor's report disclosed a series of record keeping, accounting, etc. deficiencies at the Videoton Company. These were so numerous and of such magnitude that only an approximate picture can be given about the balance and management problems of the enterprise group. Nor is there a clear picture of the role of the business and accounting deficiencies part of which derive from the earlier—sometimes—"unique" government handling of Videoton or from causes interdependent with this.

The long-term credit debts represent a serious burden for the VEV, not only because of their size, totaling 3.3 billion forints, but also because of the interest on them which has increased in the meantime. The interest payment obligations of the VEV on the credits mentioned will be 1.040 billion forints in 1990. Videoton assumed about 88 percent of the 3.3 billion forints for military industry purposes; the development of its financial balance depends especially on the situation of the military industry profile, or on its future fate.

In the past decade the Videoton enterprise became one of the bases of the Hungarian military industry, the share of the firm is about one third of Hungarian military industry production. The Soviet Union buys by far the greatest part of military industry products in zero balance deals, paying exclusively with military industry products. The reduction in Videoton's Soviet orders can be directly related to the fact that for budgetary reasons the Hungarian government has reduced military expenditures several times since the beginning of 1989 and thus has reduced army import.

At the end of 1980 the enterprise received 2 billion forints credit for the DEIMOS program; it had to pay back 1.089 billion forints of this by 1994. Although the investment goal was met and the planned receipts and profit were realized (the leaders of the VEV dispute that the investment paid off), repayment now represents a serious problem because of the unjustified prolongation of the repayment schedule. With an enterprise financial strategy aimed at greater security there could have been an accelerated payback (especially between 1986 and 1988). The error of the leadership at that time is hardly disputable.

The fifth developmental program for radio manufacture, to the tune of 3.137 billion forints, was approved by the government in 1986, but even then one could have seen that in the medium term military industry production would have to be cut back. The enterprise prepared for this eventuality and modified the list of installations for the investment in time. They finally spent 1.490 billion forints of the 2.038 billion forint fixed assets prescription of the credit on civilian or infrastructural developments. As a result of the modified investment strategy the value of the military industry fixed assets which can be converted to civilian or public needs purposes is now less than 100 million forints (about 25 million forints according to enterprise estimates). The repayment obligation due to the fifth program for radio manufacture is now 1.793 billion forints. Meeting this is not a serious problem because of the present or predictable sales problems or cutbacks for military industry production but rather because the yield from the civilian developments carried out "in the shadow" of the program is low. Indeed, several projects show a loss.

Videoton cannot bear the military industry credit burdens, nor is a settlement of them in a package plan contrary to national economic interests. At the beginning of 1990 a proposal was made at an inter-ministry meeting which would require the coordinated participation of the government, the bank providing the credit (the MHB) and the enterprise in regard to the guarantees.

Videoton Investment and Development Actions With Civilian Goals

The nonmilitary investments and developments of the enterprise did not constitute parts of a uniform strategy. Realizing them without thinking them through has a great role in the present operational problems of the enterprise group.

a. The Thomson Program

The technical backwardness of television manufacture by Videoton became obvious by the middle 1980's and urged action. Out of the program came a "flagship project" not without prestige elements and a disproportionately large part of the resources of the enterprise, and later of the enterprise group, were subordinated to it. The basic idea cannot be disputed technically, but it is very questionable on the basis of what financial considerations the enterprise leadership got into a TV project of such size when they were not sparing money in a number of other areas (see below—the editors) for developments aimed at swiftly catching up with the Western technical level.

Serious errors slipped into the realization of the program. With the technology the enterprise also bought manufacturing rights for a product the parts supply background of which could be ensured, under the given circumstances, only by the expensive purchasing of the Thomson kits, and with a market limitation agreement the FRG-French firm skimmed off the profit of Western European sales. The Thomson TV's being exported do not include the model profitable for Videoton, and the situation is no better for the traditional TV's. Dividing up television manufacture demonstrably increased costs due to a system of accounting prices among the member enterprises which aided accumulation. Introduction of the Rovex product family, which promises some solution, is late. Orion, which conducts an international cooperation policy a good bit better thought through, is spreading on the domestic TV market at the expense of Videoton. One cannot accept that deficit production for several years is the "tuition" paid for introducing a new, world level manufacture; the enterprise must pay these losses.

b. The Lohse (Thick Film Technology) Project

This technology was adopted at the Radio Factory, in cooperation with the German Lohse firm, because in 1988 the Soviet Union indicated a need, beginning in 1991, for military communications equipment containing more modern parts. Handing over the manufacturing line slipped by about nine months, not least of all because of the payments difficulties of the Videoton Company. The direct loss deriving from the investment during the 6 year cycle time of the investment is 111.3 million forints, but the technology obtained is very modern and, as the Soviet side has cut back, it can be converted almost immediately for Western European markets. The Radio Factory leadership has realistic ideas for marketing which will ensure full capacity exploitation of production. It is worth considering the organization of a separate company within the enterprise group for the project—together with the financial burdens of it. In this arrangement the building would be a

share of the VEV, as property manager, and the new firm would lease the equipment from the Lohse firm, with the cooperation of the Deutsche Bank, according to the present program.

c. The BOA [Equipment Oriented Circuits] Program

Adopting the manufacture of equipment oriented circuits within Videoton took place at the initiative of the OMFB [National Technical Development Committee] according to a concept worked out with the KFKI [Central Physics Research Institute]. The program began in 1984. Its costs come to about 150 million forints, and only 5 percent (!) of the capacity created is being used. The project is a serious failure, as were the similar parts manufacturing investments of the MEV [Microelectronics Enterprise] or the Hiradastechnika [Communications Engineering] Cooperative, but the responsibility is only partly that of the enterprise. Forcing the domestic manufacture of microelectronic parts was one of the crude conceptional errors of the earlier industrial policy.

d. The Optics Project

The net costs of the program so far come to about 600 million forints, but part of the loss can be conceived of as enterprise support for domestic technical higher education and research; but the capital strength of the firm was not sufficient for this. The enterprise group must bear the financial losses, but the project also has collateral profit (the knowledge of the engineers who participated in postgraduate training and the indisputable international recognition received for the technical achievements of Videoton, which could attract foreign working capital to the enterprise group).

e. The CD Project and the Gloria Enterprise

The Gloria company was formed in 1988 with 250 million forints base capital, 35 percent Dutch, 5 percent each for Hungaroton and the MHB and the rest VEV, and then the investment went ahead full steam. Starting up production was delayed in part due to faults of the Dutch partner and management has been made difficult by the working assets shortage which lasted since it was founded and by the stagnation of the Western European market for compact discs. The undertaking lost 19.5 million forints in 1988 and 6.7 million in 1989 (supplementary contributions by the members almost completely covered the 1988 losses).

The prediction of the enterprise leadership that production will be profitable in 1990 seems realistic; this will involve about 4 million dollars in exports. Gloria will probably remain a modest but reliable source of dividends for the VEV and will require no special personal, financial, or organizational measures.

f. The NYAK [Printed Circuit] Program

The enterprise leadership decided on a printed circuit manufacturing investment in 1984 and aimed at beginning plant scale manufacture in 1988. In 1986 the investment was made part of the fifth military industry investment program for radio development, in connection with converting part of the investment sum to civilian purposes. In the meantime the capacity prescription was expanded and the costs requirement almost doubled between 1984 and 1988, to 1.1 billion forints. In February 1989, the Parts Company was created for this investment by bringing in the firms in which Waltham had an interest, the VEV having a 60 percent share and Transelektro 5 percent. Technical transfer of the investment was postponed a year and the start of manufacture is still delayed for liquidity reasons, a serious lack of organization and the slippage in the 20 million marks foreign exchange credit required by the VEV. The firm cannot be expected to operate without shocks even after manufacture starts up because the VEV is burdened with high leasing fees and building rent costs. Nor is it clear in which direction marketing will take place; according to the original plan 50 percent of the production would be taken over by the member enterprises of the VEV (at prices 20 percent higher than the export prices). But the solution recommended by us for the forced delivery links within the enterprise group shake this idea in its foundations and it is not certain that Western European interest in Hungarian printed circuits is sufficiently great. Foreign participation in the enterprise is problematic. The fate of the firms founded by Waltham depends greatly, if indirectly, on the future of the Videoton Enterprise group.

g. The Automatics Joint Enterprise and the Robot Project

The VAKV [presumably, Videoton Automatics Joint Enterprise] was formed in 1988 as a mixed Videoton-Simera enterprise to manufacture line printers and automatics. The Simera share derived in part from license fees. The robot project brought together four different development and investment trends. Two started with the participation of the Austrian IGM, but one halted in the initial phase and the other is far behind the projections for Soviet and Austrian market sales. The situation of the other two subprograms, with the Swiss Demareux firm, may be safer but even there plant scale manufacture has not yet started. In part because of the lack of success of the manufacturing cooperation mentioned the VAKV began development in several directions to get Western, and in small part Soviet, orders; they are planning electric motor manufacture with a World Bank competition and have undertaken to deliver parts for a number of Western firms. So far they have made about 45,000 dollars from the latter and they count on nearly doubling this during 1990. Starting the robot project was a mistaken decision based on greatly overestimating the cooperativeness of the Western partners and the ability of the Soviets to pay. Thanks to its fast reaction the enterprise has been able to stay on its feet so far and according to some data it is not operating at a loss. But its strategy is not clear and many of its developmental and cooperation ideas seem chancey

h. The Videoton Housing Development

So far this program, which has raised a great storm, has cost the VEV 239 million forints. Its chief purpose was to encourage the settlement in Szekesfehervar of well trained domestic and foreign experts, thus tying them to the firm. As with many other programs here also one can and must ask why an enterprise in a swiftly deteriorating financial situation, momentarily without liquidity problems but with great credit burdens, should begin a prestige type investment serving only long-term goals when the sums thus used might also serve financial stabilization (building up a reserve). In addition, even in the initial phase of the investment it could be seen that the serious capital shortage at a large number of the VEV member enterprises being formed was causing dramatic working assets and liquidity problems. But with this program—in contrast to the producing investments—one can always count on selling the enterprise property share created. If possible this should be delayed until after completion of the development. Although it is doubtful that the planned 106 housing units can be sold at value in an area in—very likely—an economic crisis, still this action as a whole does not threaten serious losses and could even bring a modest profit.

So not one of the eight programs promises more than painful survival (in the best case) for the VEV or the member enterprises founded on it. Not one of them indicates a breakthrough point defining the future of the enterprise group. Knowing the situation of the budget, the financial situation of the country and region, one can expect larger developmental resources only from abroad. Even mere vegetation, the best alternative scenario under domestic conditions, is rationally possible only by bringing in foreign working capital in a better thought out, more intensive and "cleaner" form than heretofore.

Foreign Market Positions and Bringing in Working Capital

The report signed by Janos Kazsmer on 30 July 1990 describes and confirms the earlier foreign cooperation concept of the enterprise leadership. According to this the strategy to bring in foreign capital was based consistently on two interlinked basic principles. One was the survival of the Soviet market as a priority marketing direction and the other was to seek "strategic alliances" and linking them to the enterprise group. The latter would be Western firms with capital strength and front-line technology which were inclined to invest in the enterprise group. Fundamental to their motivation, as emphasized by the report, was (would be) an effort to build their penetration of the Soviet market on the presence there of the Videoton group. It would be in vain to throw out this two pillar strategy as long as only the enterprise group undertook the risks of it. But there was also an image of the future behind the concept. According to this the survival of the enterprise group could be ensured only with the dominance of Soviet market sales, given the size of the enterprise group there could not be enough solvent demand at home for the "volume" products. And it could not be competitive in the West with large volumes because of competition problems and the saturation of the markets. But as marketing conditions swiftly deteriorate in the Soviet Union the enterprise group expects effective government action to improve them—naturally at the expense of the other large machine industry enterprises. According to this logic this is the pledge of the survival of the enterprise group from the market side.

In 1990 the enterprise group tried to put this "fatalist" foreign market strategy into practice by founding two new mixed enterprises which represent a radical break with the previous Waltham centered joint venture policy. Of the two the SEL mixed enterprise already exists, but in essence it does not function. Its existence would be justified if it won the rural telephone network tender put out by the Hungarian Post Office in 1989. Videoton-SEL Telecommunications Ltd. was formed for this tender. The capital share of the German party is now 13 million forints (about 300,000 marks), but this would increase to 30 million marks when manufacture started up. The undertaking could also count on other serious capital injections (for example within the Baden-Wurttemberg credit deal). But the conditions of the tender have changed several times in the meantime and a decision has been postponed (obviously because they want to encourage the bidders to undertake larger foreign exchange obligations). If the corporation wins the contract (nine have applied, two of which have a chance) it still has not overcome every obstacle. It would also need to win Soviet orders, to an annual value of about 60 million dollars, to fully exploit the planned capacity. And to do this an already working mixed enterprise would have to get itself on the priority lists of the Hungarian and Soviet governments. So the corporation, now employing 30 people but which might employ 600 workers (primarily from the Radio Factory) in the event of full capacity use, cannot lay claim to especially good survival prospects.

Penetrating the Soviet market was virtually the exclusive motive of Bull, which subscribed as the 49 percent joint owner of Hungarian-French Informatics Ltd. in June 1990 (their 49 percent now comes to 594 million forints, about 9.5 million dollars—the VEV has 51 percent). The French firm is willing to participate, up to a 49 percent capital share, in an investment in Hungary coming to at most 100 million dollars, linked to the expected guarantees.

The task of the mixed enterprise is supposed to be to keep alive the computer technology profile of the Videoton group, now struggling with serious problems, and bring it technical renewal. But it can be seen that Bull would prefer to employ in the MFI [Hungarian-French Informatics] those experts of the Videoton group (the Videoton Company, Computer Ltd., Software Ltd. and Walton Ltd.) who deal with software development and sales and service. As of 6 July 1990, the MFI took over supervision of the three small enterprises listed. The signs are that the capacity of the Computer Technology Factory will decrease within the MFI and the emphasis

will shift from manufacture of basic machines to peripherals (monitors for example, in a new plant planned with a 10-15 million dollar investment).

Two reservations should be mentioned in connection with the future of the MFI. One is that Bull is demanding excessive guarantees and concessions from the Hungarian government. Among other things they are demanding that the tax concession customary for mixed enterprises be applied to those member enterprises of the MFI group which are 100 percent Hungarian owned and that the government undertake an obligation to "reduce to a minimum any unfavorable effect on the mixed enterprise" from use of barter mechanisms. Both conditions are unacceptable, especially the latter, because it contains too general an obligation. The demands for 10 years free of taxes, the government's prior surrender of any form of production tax, the "open" obligation pertaining to a duty free zone, and the promise by the government regarding duty free imports and leaving unchanged the "afa" tax system affecting the firm are not justified. All this would make the MTI [as published, MFI was intended] in Hungary, with majority Hungarian ownership, more than "extraterritorial."

The other reservation is that the market predictions of Bull, or the MFI, in connection with expected Soviet sales are excessively optimistic, strikingly unrealistic in both the prices and volumes predicted. It would be dangerous if the government were to quietly accept the marketing predictions (for example they are planning on receipts of 813 million French francs in 1991 and 1,340 million in 1992, 80 percent from the Soviet market) when granting the requested concessions and guarantees, and this would seriously hurt the interests of other Hungarian machine industry exporters. And it is probable that part of Soviet-Hungarian trade will be forced into more or less closed deals; for example, the Hungarian electronic exporters will be competing for the Soviet market not with the similar firms of other countries but rather with other Hungarian machine industry enterprises, and obviously they will not be using only market tools.

Finally, there is a conceptual problem with the MFI, that in this way Bull gets a strategic control position over all the computer technology manufacturing and sales of Videoton. While it gets cheaply the indisputably valuable Soviet market organization it does not guarantee for the longer term the maintaining of domestic production. If the leaders of the VEV and the Videoton Company really accept the Bull concept for acquiring the MFI they will be silently acquiescing in a loss of personnel, even for the middle term, of the sort they are trying to prevent in other profiles indirectly at the expense of the budget. In other words, if the VEV intentions in connection with the MFI are serious, then we cannot take entirely seriously the holding on to a large part of the personnel which the leadership regularly emphasizes as a chief argument for keeping the enterprise group alive artificially.

Budapest, 16 August 1990.

Problems With Polish Rural Network Digital Services Discussed

91WS0174A Warsaw WIADOMOSCI TELEKOMUNIKACYJNE in Polish Dec 90 pp 1-3

[Article by Jerzy Trechcinski: "Nontelephonic Digital Services of the Polish Network"]

[Text] This article is designed to examine the desirability of renovating the telephone network in accordance with the Prognosis, or of simultaneously constructing a separate, universally integrated telecommunications network superimposed on the Polish telephone network. The program for renovating the telephone network envisioned for the 1991 to 1995 period and the possibility of servicing this network after the renovation is completed are described briefly. Based on this, the desirability of constructing an additional network during this time period is substantiated. The structure of this network, its operating characteristics and its operation with the telephone network are described.

A second network can satisfy needs in the realm of modern telecommunications services encompassing all of Poland's territory. Thus, preferences are proposed for specific nontelephonic digital services in Poland during the described period.

Poland's telecommunications network is antiquated and, in essense, provides only traditional services such as telephone and telegraph services. Data transmission services and telemetry services are just beginning to appear. Poland is among the laggards of Europe with respect to number of telephones per capita.

In the long-term prognosis for the expansion of Poland's telephone network, as a starting point (about 1990), it is assumed that there are about 3 million telephone subscribers. It is projected that about 2 million additional subscribers will be added during the period under consideration, a large part of which will be serviced by electronic exchanges. During the next network renovation phase, software-controlled electronic systems will predominate.

According to current plans, subscribers are served by 109 area codes. The number of subscribers included in an area code varies, depending on the number of residents and the economic development of Poland's individual areas. Three hundred and eighty districts with urban areas in their centers are encompassed by these area codes. These districts include over 50,000 rural communities incorporated within 2,000 gminas.

Poland's most important voivodship cities are covered by 12 area codes. The remaining voivodship cities utilize 37 additional codes. The remaining area codes cover areas incorporating primary nonvoivodship cities that encompass a smaller number of subscribers than are located in the first 49 areas. Automatic toll junction

exhanges [ACMM-W] are located in the main cities of the first 12 area codes. They are part of the highest level multilateral network and are located in different parts of Poland. As a result, Poland's network is divided in a natural way into 12 regions of about 25,000 square kilometers each which include an average of about 10 area codes. It should be noted that in the initial stage about 2 million urban subscribers live in the 80 cities of the main districts, but only about 1 million subscribers live in the remaining 300 towns. At the same time it also can be said that barely 10 percent (approximately) of Poland's district exchanges contain two-wire switching exchanges. In addition to manual exchanges, most district headquarters contain old automatic exchanges of the the one-wire switching type. They can still be utilized for some time as local exchanges.

A similar situation applies to rural end centers. About 90 percent of the centers (manual and relay-type exchanges) for the existing approximately 330,000 NN should be discarded and replaced by centers that conform to technological and operating requirements. In this situation most of the equipment in the district networks in operation during the initial phase need to be upgraded. Switching and transmission systems should be based on digital techniques. However, considering the production capabilities of Poland's industry, about 10 percent of the telephone subscribers will continue to be served by relay-type exchanges and about 50 percent by crossbar exchanges. It will be necessary to locate switching centers within the network such that electronic exchanges or crossbar exchanges (preferably for two-wire switching) would be at the transit junctions. In addition to telephone communications, the original subscriber connections of the crossbar and electronic systems could be used to connect via appropriate modems videotext, telefax, telex, and data transmission terminals operating at transmission speeds of up to 2400 bits/s.

In renovating the telephone system, it is assumed that, above all, transit centers using digital technology will be used because they significantly improve the transmission quality of domestic and international connections. District centers must also use digital technology because of the necessity to obtain quality transmissions in connection to rural network subscribers.

In this situation, all ACMM-Ws and a significant number of automatic toll echanges [ACMM] in the remaining voivodship cities should implement digital switching. Because the capacities of these exchanges are relatively large, their structure can be modular. In conjunction with this, the smaller centers can also be exchanges using toll switching modules and zone switching modules. The electronic systems used in the described exchanges should be designed to operate with the future integrated domestic network with telecommunication services.

The inadequate development of the telephone network, its inadequate digitization and the urgent need to use nontelephonic digital services call for the simultaneous construction of a universal digital network for the economic organizations that are expanding all over Poland. Here it should be emphasized that many countries as well as the leading economic organizations decided to create specialized networks having the simplest designs possible for specific services or their small collections even when the requirements for an integrated service network were not precisely defined. An additional argument favoring separate networks is that it is easier to safeguard information.

Currently, the concepts for a universal network, for example, a network with integrated services, are well developed. The requirements concerning basic procedures and information exchange systems are defined. Very modern digital transmission and switching equipment, conforming to international requirements, are available from the leading producers. All this argues against Poland now getting involved in creating specialized networks, and for building one additional universal, integrated network that would provide high quality telephone service and nontelephonic digital services for domestic and international traffic. It should be a digital multiservice network with switching centers capable of switching 64 kbits/s time-division channels and packets. These switching centers, based on modern achievements of electronic technology, should be software controlled and contain standard interfaces and equipment that are compatable with the CCITT [Consultive Committee International Telegraph and Telephone] Nr. 7 signaling recommendation.

The described integrated network will satisfy needs in the realm of modern telecommunication services for all Poland. This network's main switching center should have the predetermined functions of the international center and regional center for the central region. It is anticipated that a junction center and appropriate end centers as well as digital switching concentrators will be included in the structure of this central region and other regional facilities. In general, the regions of the integrated system will be the same as the regions of the existing telephone network, and the MNA international center and the ACMM-W toll centers should contain their own digital system switching modules for operation within the integrated network. In conjunction with this, the described universal network should operate with Poland's existing telephone network at the MNA center level as well as with ACMM-W centers, other ACMM centers and, in some cases, MCA zone centers.

To operate the junction centers as simply and economically as possible and to ensure their operation with the MNA and ACMM-W centers of the telephone network, the modules of the universal network's junction centers should also be considered for use in the named centers. The central region junction center, which is supposed to operate with other designated international centers as well as the MNA international center of Poland's telephone network, can be utilized as an MNA module or an ACMM-W in this region. Other junction centers can be utilized in a similar manner as ACMM-W modules.

Taking into consideration that the number of subscriber numbers in the integrated network will not exceed 800,000, one can expect the numbers to be six-digit numbers, the same as projected for an existing telephone network for a typical area code with this capacity. In this situation, the mentioned six-digit numbers should be preceded by a designated two-digit indicator to reach an integrated network subscriber from the telephone network and international network. In turn, an integrated network subscriber should use the "O" prefix (and the domestic number) to connect to telephone network subscribers, and the "OO" prefix for international connections. The numbering system for the special services for integrated network subscribers and the numbering system for subscribers to the land mobile communications network can be as projected in the domestic numbering system plan.

One should anticipate heavy traffic for the described integrated network. Average traffic intensity on the order of 0.15 Erlang is projected distributed as follows: 0.05 Erlang, traffic within the integrated network; 0.05 Erlang, traffic with telephone network subscribers; 0.05 Erlang, traffic with the international network. The integrated network should also ensure automatic radiotelephone communications with mobile subscribers (up to 10 percent of the described network's entire capacity) in a cellular-type network whose regions will match those of the stationary communications network. The integrated network should provide the basic and supplementary telephone services listed in the CCITT recommendations; telefax services; telex services; access to videotext services; and data transmission services via packet and channel switching at transmission speeds of 9600 bits/s and via switched digital links at 64 kbits/s. Multipurpose subscription-card-type telephone equipment, subscriber exchanges, and subscriber local networks can also be connected to this network. For subscriber networks, in addition to analog links and digital links at transmission speeds of 64 kbits/s, one should plan for digital links that meet CCITT recommendations.

Digital links at transmission speeds of 140 Mbits/s based on fiber-optic technology or radio links should be used to interconnect regional centers. End centers should be linked with one another with junction centers via digital links at transmission speeds of 64 kbits/s achieved by pulse-code modulation systems having a multiplication of 30, 120 or 480 links, preferably radio and fiber-optic links. The integrated network's signaling systems should include: the R2 signaling system to permit operation with Poland's telephone network and the existing European network; the [CCITT] Nr. 7 signaling system to permit operation within the frameworks of the described system and with the new international system; and signaling [sysstem] Nr. 5 in accordance with CCITT recommendations to permit operation with the existing intercontinental network.

Traffic from subscribers of the described network to subscribers of the domestic telephone network using domestic numbers can be routed from the junction centers of the described network via the primary paths to designated local and toll centers or via alternate paths through ACMM-W toll centers of the telephone network. Traffic in the opposite direction should be routed through the toll centers of the telephone network to the nearest junction center; in the former and latter cases, the principle of creating linking paths primarily from elements of the integrated network should be observed. The international traffic of subscribers of the described network should be routed via the main regional center directly to and from cooperating international centers, or via modules of the digital international center of the domestic telephone network to and from other international centers.

The digital telephone network design and the parallel digital universal network design encompassing the entire country that are described here take into account the successive introduction of modern packet and channel switching services. Here, of most importance, telefaxing should be converted, which, just as in countries of significant econonomic and telecommunications potential, should become more popular in Poland's medium-size offices, in large commercial, financial and tourist firms, in industrial organizations and scientific laboratories, in design offices, and among representatives of independent professions. Telefax at transmission speeds of up to 2400 bits/s can now be connected to existing subscriber telephone network connections. Transmissions over existing subscriber lines at speeds of up to 9600 bits/s and transmissions over digital links at 64 kbits/s are projected for this second network.

Currently the development of data transmission in Poland is unsatisfactory despite the great demand for this service. Among other things, this is due to the limited possibilities for leasing lines. If the universal network is built, one can assume greater expansion of this service via channel and packet switching at transmission speeds of up to 9600 bits/s and via switched digital links at 64kbits/s.

Videotext is another needed service. The transmission of graphics to home televisions, videotext terminals, and personal computers should be considered. At the same time, regional networks of computer information centers should be organized, which would receive data from the designated institution and individuals as well as from economic organization that want to advertise.

In addition to computerized information services, videotext in conjunction with a properly organized network can also be used in our country to conclude commercial transactions, to contact banks, and for communications among its users. It shoudl be a valuable aid in commerce, public services, minor financial transactions, tourism, hotel operations, and education.

Teletext provides services that are similar to telegraph-telex services. Thanks to computerization, proper automation and a more extensive alphabet, teletext is much faster and more efficient than telex. It is expected that

teletext will replace in stages the now widely used telex. To this end, interfaces have already been developed to convert telex information to teletext-standard information and vice versa. The limited interest in teletext in Poland at present promotes relatively the expansion of the telex network and the possibility of replacing existing electromechanical exchanges with new Polish-produced electronic exchanges which also include slow data transmission services at speeds of up to 300 bauds.

In conclusion, it should be added that immediate support of the additional universal network should permit the planned advances in digitizing the telephone network and its future expansion without hampering the development of the digital network with integrated telecommunication services.

Status of Telecommunications Upgrade In Tesla Liptovsky Hradok Discussed

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[Article by Eng Jan Madara, candidate for doctor of science (CSc.), Eng Vojtech Rusnak, and Eng Karol Navara, Liptovsky Hradok Tesla: "Upgrading PBX And Business Switching Systems at Tesla Liptovsky Hradok"]

[Text]

Introduction

The beginning of 1990 marks a new stage in the development of Czechoslovak telecommunications, characterized by attempts by foreign firms to penetrate the Czechoslovak telecommunications market.

The communications sector arranged for presentations by all foreign consortiums, each of which researched the requirements for building comprehensive public digital, radiotelephone, packet data networks for the CSFR.

While the communications sector has not made its final decision on a consortium, it expects to select a specific consortium and sign contracts by the end of this year.

In addition, so far three memoranda have been signed concerning the founding of joint ventures:

— Tesla Karlin-Siemens, for the manufacture of 500,000 lines annually for a public EWSD system.

— Tesla Kolin - Ericsson for the manufacture of 350,000 lines annually for a public AXE system.

— Tesla Liptovsky Hradok - SEL Alcatel for the manufacture of 250,000 lines for a public S12 system, and 20,000 lines for the S12B PBX system.

Contracts concerning the establishment of joint enterprises are to be signed before the close of 1990.

Deliveries of telecommunications equipment from these joint ventures exceed the needs of the Czechoslovak communications system. This will result in a harsh competitive struggle , especially in view of the completion of the public digital JSPST-N switching system in Tesla Karlin, which is designed for lower network levels. Postal and telecommunications managers are planning, for efficient operation of the uniform telecommunications system [JTS], to install equipment from two, and a maximum of three, manufacturers. The basic technical requirements of the communications sector for the delivered systems include the potential for adding ISDN functionality and a maintenance system based on International Consultation Committee for Telegraph and Telephone [CCITT] standards.

In the area of PBX equipment, a change in the telecommunications law is being planned that will deregulate the PBX system market. The communications sector will probably only provide standards for PBX systems, allowing users to purchase either domestic or foreign systems based on their needs and pocketbook. In the area of PBX systems there will also be a fierce competitive struggle. This has led strategic and production planners at Tesla Liptovsky Hradok, a domestic manufacturer of PBX exchanges, to accelerate innovation with a focus on digital systems, high quality post sales service, and improved value for customers.

Main Innovation Objectives at Tesla Liptovsky Hradok

A test model of a UE 500 digital switching system for Piestany Tesla is currently in production. Experts had already received detailed information on this system at conferences and seminars arranged by the Liptovsky Hradok branch of the Czechoslovak Scientific and Technical Society and the communications sector. Production plans for next year call for the manufacture of 10,000 connections (Pp), which is the equivalent of about seven telephone exchanges. Beginning in 1991 we plan to begin manufacturing an R2 code receiving-transmitting module and a digital trunk line module that will enable digital cooperation with public exchanges that use type K signalling.

PBX System Development

Proven principles for designing equipment and software components of UE 500 systems as well as its mechanical construction are the basis for developing digital PBX exchanges with a capacity of 30-3,000 lines. Development has begun on the following switching systems in this range:
UE60 (30-190 lines)
UE300 D (200-1,000 lines)

Deliveries of these systems are scheduled to begin in July 1992. Innovations made during the development of UE60 D and UE300 D systems will be integrated into the UE 500 system. By keeping a similar mechanical structure and maximizing the amount of forward compatibility in component design we hope to increase the size of production runs in our firm as well as simplify

maintenance and reduce the number of spare parts that customers must keep on hand.

Beginning in 1991 we plan to begin development of digital line circuits for basic ISDN access. Because of forward system compatibility, digital line circuits will be implemented in the above mentioned switching systems beginning in 1994-1995, at which time we want our products to be fully competitive with imported systems.

Innovation plans at our firm also include the privatization of services and smaller operations. This will increase demands for the lowest capacity switching systems, which are financially in the reach of a wide range of customers. For this reason we have begun developing an exchange for four subscribers and a single public network relay set, called the UE2. The wholesale price of this center should not exceed Kcs 4,000.

Business System Development

In response to the demands of sectors that have private networks (transportation, power generation, interior, national defense), we began in January 1990 to develop the UE 500 V system. This system is designed to replace the UK 11P and UK 40P second generation business systems. The development of electronic analog exchanges for the sectoral network has been completed for practical purposes and production begun of the UE 201 P and UE 101 P systems. These are planned for installation at the lowest levels of the network. The UE 500 V digital system is designed for use at the level of terminal and nodal offices. We plan to manufacture business systems in the range covered by the UE 300 D and UE 60 D systems, such that by 1993 most of our production will be digital systems.

UE 300 D. Design Concept

The design of the UE 300 D system is based on that of the UE 500 system (EDISS). The UE 300 D, however, eliminates the disadvantages of the UE 500 at lower capacity levels. Because this disadvantage (mainly its size and price per line) results to some extent from the robustness of the UE 500 system core, developers of the UE 300 D have to make some modifications, the objectives of which are to:

— Minimize the number and space demands of system core modules and selected peripheral modules, and to minimize system core module costs;

— Assure appropriate use of all system core resources;

— Retain most of the UE 500 system software either directly or by transferring and reconfiguring partial program products.

These objectives will be reached mainly by:

— Integrating individual system core modules into smaller structural units.

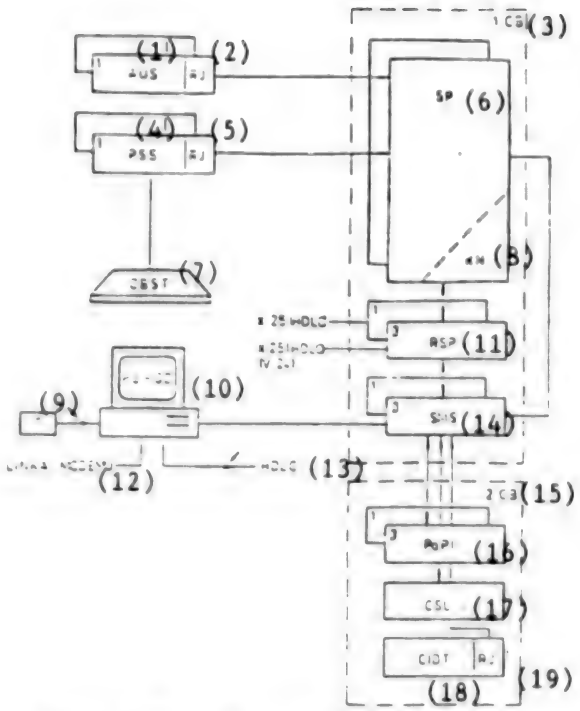

Figure 1. Block Diagram of UE 300 D System

Key 1. AUS—Analog line circuit—2. Control unit—3. First central chassis—4. PSS—Relay sets and operator position connect circuits—5. Control unit—6. SP—Switching array—7. OBST—Operator station—8. KN—Conferencing and busy override—9. T—Printer—10. Personal computer for operations and supervision—11. RSP—Switching array control—12. Modem link—13. high-level data link control [HDLC]—14. SMS—Intermodular reports switch—15. Second central chassis—16. PaPI—Operating information storage—17. CSL—Centralized services—18. CI-DT—Timed impulses and digital tones—19. Control unit

— Integrating the functions of various modules into a smaller number of centralized modules.

— Introducing universal positions in certain peripheral modules to meet the need for flexibility in outfitting the system with different types of line circuits and relay sets.

In addition to the foregoing, other design modifications will be made, related mainly to the need to provide greater ease of diagnostics, operation, and system maintenance, as well as the need to make use of previously standardized and installed designs that were introduced as features specific to the UE 500. Modifications of this type will be made with the intention of reintegrating some of the newly developed functional blocks into the UE 500 system. This will improve the quality of this system, and also reduce the number of pluggable units and modules.

System characteristics:

— 200-1,000 line capacity,

— Distributed microprocessor control,

— Modular architecture,

— Pulse code modulation (PCM) compatible with CCITT and CEPT [European Conference of Posts and Telecommunications],

— Individual codec,

— Digital switching arrays (TDM) without blockades,

— Built in automatic diagnostics,

— Compatibility with public data network (through X.25),

— Modularity: 8 line circuits per board (pluggabl unit), 4 (2) relay sets per board,

— Cooling without required air circulation,

— Potential to use modem pool for data transfer and switching,

— Telematic services implemented through optional server type module,

— Future potential to implement more digital line circuit modules.

Four chassis are the basic structural elements of UE 300 D systems. Two of the chassis are peripheral modules represented by the analog line circuit module (AUS) and the relay set and operator position connect circuits module. The other two chassis are the so-called central chassis and are marked as the first central chassis (1.CB) and the second central chassis (2.CB).

As shown in the block diagram in Figure 1, the 1.CB is the location of the intermodular reports switch (SMS), and the switching array (SP) with an integrated conference and busy override set (KN). The switching array is controlled by the switching array control (RSP) which is equipped with a port to the public data network.

The second central chassis contains two operating information storage modules (PaPI), one central services module (CSL), and a timed impulse and digital tone module (CIDT). The central modules also include an operator and supervisory module, implemented with a personal computer (PC) equipped with a communications adapter card to provide a uniform interface between the system and the PC. The PC is also equipped with a bus card with the high-level data link control [HDLC] protocol which provides a basic communications path for all modules with an original SEMA (serial bus) designation. When the system is connected to a centralized maintenance and supervisory center the PC will also be equipped with a modem to transmit necessary reports and commands.

The digital switching array (1,024 channels) has enough reserve capacity, given the nominal maximum capacity of the system, to allow the installation of additional modules such as a modem pool, server, and digital line circuits. The capacity of the switching array is designed so that 50 percent of the connections can be digital line circuits while still providing a wide range of telematic services. The modules mentioned above will be identical in both the UE 500 and UE 300 D systems.

Module Descriptions

- Analog line circuit module.

Basically identical to the AUS module in the UE 500 system; no major changes needed.

- Relay set and operator position connect circuit module (PSS).

The PSS module is a universal structural unit for all kinds of relay sets, including those for digital tie lines. The module has eight positions designated for the locating of quadruple relay sets, and four additional positions for locating double relay sets, with positions 1-8 also capable of handling double relay sets. In total, it will be possible to install 30 relay sets in a PSS in any combination of relay set type.

Alternatively, two operator position connect circuits can be installed in positions for a double relay sets, as an interface for a maximum of two operator stations. Operator stations for the UE 500 will be utilized with no changes, or with lower level innovations.

- Switching Array

The switching array has a modular architecture, allowing a gradual increase of capacity from 256 channels to a maximum capacity of 1,024 channels. The conferencing and busy override lines are integrated into the switching array. The switching array has full redundancy, with a synchronous reserve. The switching array control operates in stand-by mode. It is equipped with automatic diagnostics and a monitoring system for the exchange of intermodular information. The switching component uses only one type of pluggable unit.

The conferencing and busy override set has 30 working channels allowing a maximum of seven conference participants. The 30 conference channels are allocated flexibly to the necessary number of conferences based on immediate operational requirements. The set can be programmed to control signal gain. Each board of the switching array has one conference block with a 30 channel capacity. This means that up to four conference sets (blocks) can operate in the system.

- Intermodule Report Switch

The intermodule report switch is designed to exchange information among the module control units of the entire system. It is constructed as a rapid packet switch with a capacity of 64 channels, which allows the system

to be expanded to a final number of 60 modules. It has full redundancy and is equipped with monitoring functions for the information exchange.

- Operating Information Storage

This module is taken from the UE 500 system. The possibility exists, however, as part of innovations, to distribute its functions to individual system modules, which would eliminate the need for it.

- Timed Impulse and Digital Code Module

This is basically taken from the UE 500 system, but in view of the substantially smaller number of modules certain circuits and insertable modules can be eliminated, thus reducing the size of this module.

- Central Service Module

This is basically a control unit without any additional circuits. This means that it is taken from the UE 500 system.

UE 60 D

The UE 60 D system is aimed at allowing the economic implementation mainly of small digital PBX systems with capacities in the vicinity of a rated capacity of 64 lines/eight relay sets. The pluggable modules of this system are located in a single UE 500 system chassis, which is installed in a wall cabinet along with a voltage changer, power box, and a battery charger and disconnector. Expanding this exchange to another wall cabinet (with another chassis and voltage changer) brings the capacity close to a rated capacity of 190 lines/20 relay sets. By connecting these units using a category I PCM track (utilizing a 30-channel digital relay set) with a public exchange it is possible to increase line capacity or to increase the number of inter-PBX line relay sets, at the expense of saved analog relay sets.

These exchanges consist of a non-redundant digital switching array, with control of the switching processes handled by a single, nonredundant microcomputer.

It is also possible to provide redundancy for the central switching array and controlling microcomputer of a UE 60 D system and, after adding additional chassis, further expand exchange capacity (by approximately a factor of two). The chassis and other equipment of such exchanges (changers, power supplies, battery chargers and disconnectors, ring signal generators) are then located in a standalone UE 500 system cabinet. The UE 60 D system retains the line circuits as well as all types of analog relay sets used in the UE 500 and UE 300 D systems. As with these systems, it is possible to use the R2 multifrequency code by cooperation through a P3PN preselection relay set or through a digital relay set (with K signalling).

The UE 60 D system basically retains the modular structure of the equipment and software of the UE 500 system.

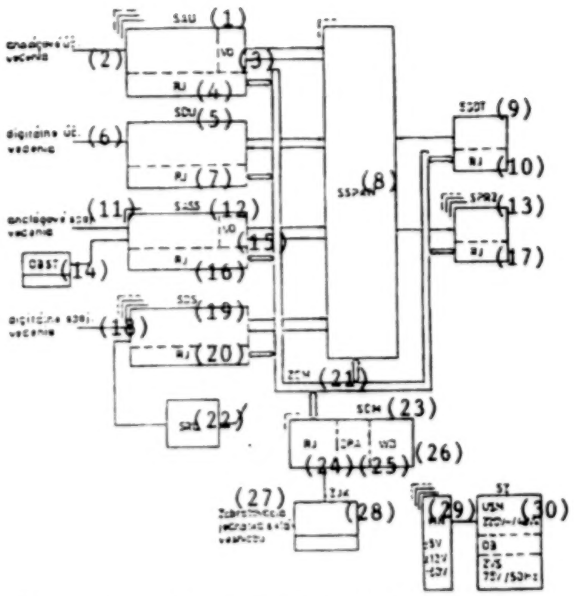

Figure 2. Block Diagram of UE 60 D PBX Exchange

Key 1. Analog subscriber group set—2. analog subscriber lines—3. Connecting circuits—4. Control unit—5. Digital subscriber line set—6. Digital subscriber lines—7. Control unit—8. Switching array, conferencing, and busy override set—9. Digital tone generator set—10. Control unit—11. Analog junction line—12. Analog junction line and operator set—13. R2 code receiver set—14. Operator station—15. Control unit—16. Connecting circuits—17. Control unit—18. Digital junction lines—19. Digital junction line set—20. Control unit—21. Central computer bus—22. Control oscillator set—23. Central microcomputer set—24. Control unit—25. Dynamic memory—26. Winchester drive—27. Monitor and keyboard—28. Monitor and keyboard—29. expansion unknown—30. expansion unknown

The central microcomputer (CMP), to the extent that it replaces the controlling microcomputers of all modules, becomes a component of these modules. The remaining equipment of all modules (after removing the functions of the controlling microcomputer) is then called the "set" of that module. The set of each module is equipped with its own microcomputer which the set uses to communicate with the CMP over a serial control bus. For the SAU and SASS sets this microcomputer also performs the functions of a preprocessing microcomputer.

Figure 2 shows a block diagram of a UE 60 D system. The exchange consists of these sets:

SCM (Central microcomputer set). Replaces the OD, SMS, PaPI, RSP, CSL, and control microcomputer modules, as well as the AUS, PSS, and CIDT dynamic memory modules of the UE 500 and UE 300 D systems.

SAU (Analog Subscriber Group Set). Replaces the AUS module, in conjunction with the CMP.

SASS (Analog Tie Line and Operator Position Connect Circit Set). Replaces the PSS module, in conjunction with the CMP.

SDS (Digital Tie Line Set). Replaces, in conjunction with the CMP, the digital tie line module (DSV) and the generators of the code receiving and transmitting module (KPV).

SSPKN (Switching array, conferencing, and busy override set). Replaces the SPKN module, in conjunction with the CMP.

SGDT (Digital tone generator set). Replaces the DT module, in conjunction with the CMP.

SPR2 (R2 code receiver set). Replaces, in conjunction with the CMP, the receivers of the KPV module.

SRO (Control oscillator set). This is a simplified CI module.

SDU (Digital subscriber line set). This set will be developed during the equipment and software development project to provide basic ISDN access. Along with the CMP, it will replace the digital subscriber group module (DUS).

The serial bus of the central microcomputer allows an additional planned innovation step (after introducing the DUS module to the system). This step will involve replacing the current USA pluggable unit of an SAU set (with eight analog line circuits) with pluggable units with 16 analog line circuits per board with a common preprocessing microprocessor. The software for the UE 60 D system is based on cooperation between the appropriate switching and diagnostic tasks of the UE 500 system, grouped in a RMX86 operating system. In contrast to the UE 500 and UE 300 D systems, programs for all tasks are stored in the CMP. The system retains the full range of subscriber and user services and operator workstation services of the UE 500.

Conclusion

Beginning in the second half of 1992, Liptovsky Hradok Tesla will be delivering both the UE 60 D and UE 300 D modern digital PBX systems. These two systems cover capacities of 30 to 6,000 lines. The similar architecture of these systems as well as their uniform mechanical construction allows the manufacturer to implement economically in all digital systems the functions of enterprise networks. Beginning in 1991 we plan to develop exchange equipment for narrow band ISDN networks, with expected delivery dates for the Czechoslovak market in 1995.

In the case of the UE 60 D and UE 300 D exchanges we had also planned versions for the public network. Because, however, of the joint ventures being formed to manufacture S12, EWSD, and AXE public systems, and the formulation of a new strategy for the communications sector, we have scrapped these plans.

We are confident that the high technical sophistication of digital switching systems along with improvement in the quality of post sale support will allow our enterprise, under conditions of a deregulated market for PBX systems, to maintain our current position in the Czechoslovak telecommunications market.

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